

The T.R.A.I.L. Boss Manual

Teaching Resources And Individual Leadership



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Teaching Resources And Individual Leadership

by

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Acknowledgment

This manual was produced by the Boy Scouts of America in cooperation with the U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Management, Army Corps of Engineers, Environmental Protection Agency, and Soil Conservation Service.



TRAIL Boss Mission Statement

The mission of TRAIL Boss is to teach volunteer leaders specialized skills for training and leading volunteer crews involved in conservation projects resulting in environmental education and greater stewardship of cultural and natural resources.

* * * * *

Wise stewardship of natural resources is everyone's responsibility. The following agencies support the TRAIL Boss concept and urge its adoption as a valuable tool for agency personnel, conservation organizations, volunteers, and group leaders who understand the tremendous importance of involving all Americans in caring for the environment.



Forest Service



National Park Service



Fish and Wildlife Service



Bureau of Land Management



Army Corps of Engineers



Environmental Protection Agency



Soil Conservation Service



Boy Scouts of America

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TRAIL Boss Work Skills

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9. Environmental Surveying and Monitoring, 44

How to gather and use important information about stream quality, wildlife activity, changes in vegetation, and the general health of the environment.

10. Revegetation and Restoration, 56

How to repair meadows, streambanks, seashores, campgrounds, and other areas damaged by overuse and erosion.

11. Archaeology and Historic Preservation, 64

How to assist in protecting and enhancing archaeological sites and historic structures.

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How to document the needs of wild animals and complete projects to improve wildlife habitat.

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How to combine TRAIL Boss skills to improve and safeguard ecosystems dependent upon streams, lakes, and other bodies of water.

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How to care for trails in urban, rural, and back-country areas.

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Introduction—TRAIL Boss Requirements

WHAT IS TRAIL BOSS?

“Teaching Resources And Individual Leadership”—that’s what TRAIL Boss is about. Its purpose is to teach leaders of any organization the skills they need for supervising volunteers involved in meaningful conservation work on public and private lands.

TRAIL Boss makes it possible for leaders to supervise their own groups undertaking conservation projects. It also gives leaders opportunities to make environmental education an important part of their programs.

With this manual for guidance, group leaders can learn the basic TRAIL Boss skills in one of two ways:

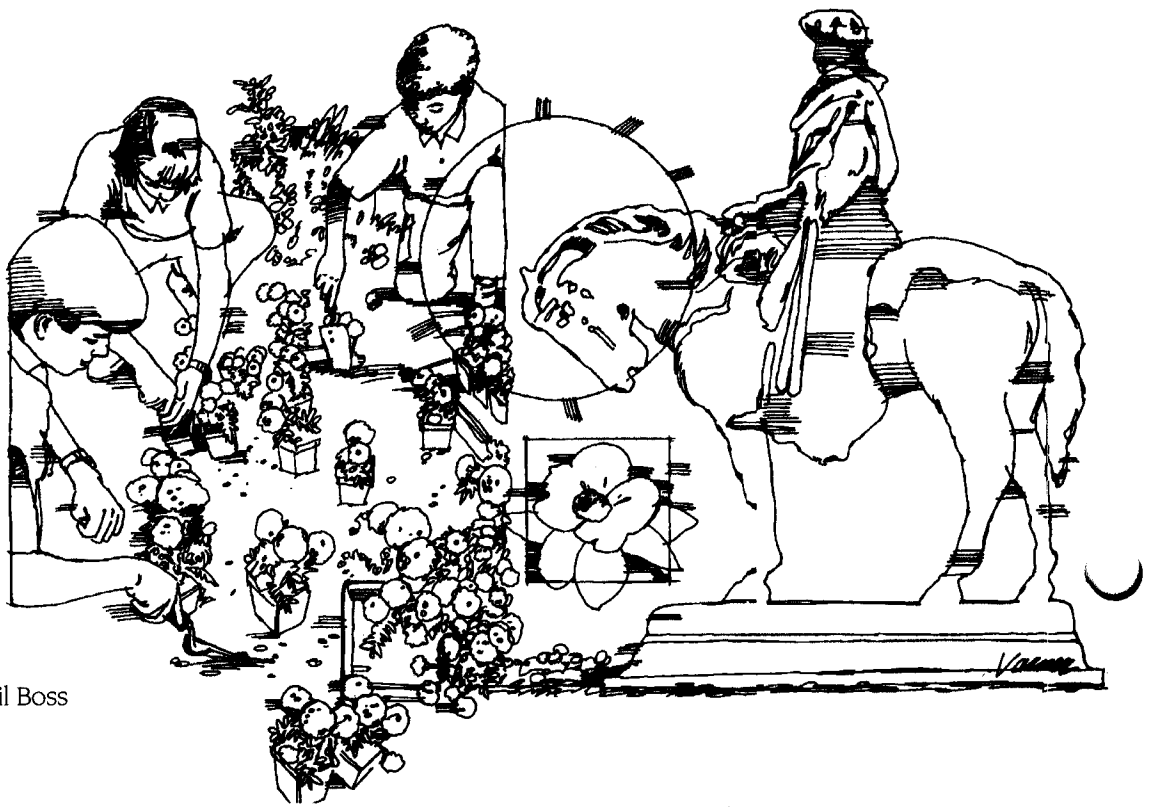
- ♦ By working beside resource managers or experienced TRAIL Bosses
- ♦ By attending training sessions conducted by an organization or agency

TRAIL Boss is a tool that increases the ability of agency staffs and other resource managers to complete essential conservation work. Because it encourages long-term partnerships between volunteers and resource managers, TRAIL Boss helps ensure that the effort devoted to training group leaders will be returned many times over.

WHAT KINDS OF PROJECTS CAN TRAIL BOSSES SUPERVISE?

The TRAIL Boss requirements are designed to guide leaders through the process of evaluating the strengths and interests of their groups, finding and getting acquainted with resource managers who have conservation work to be done, learning essential work skills, and then overseeing a series of increasingly demanding projects.

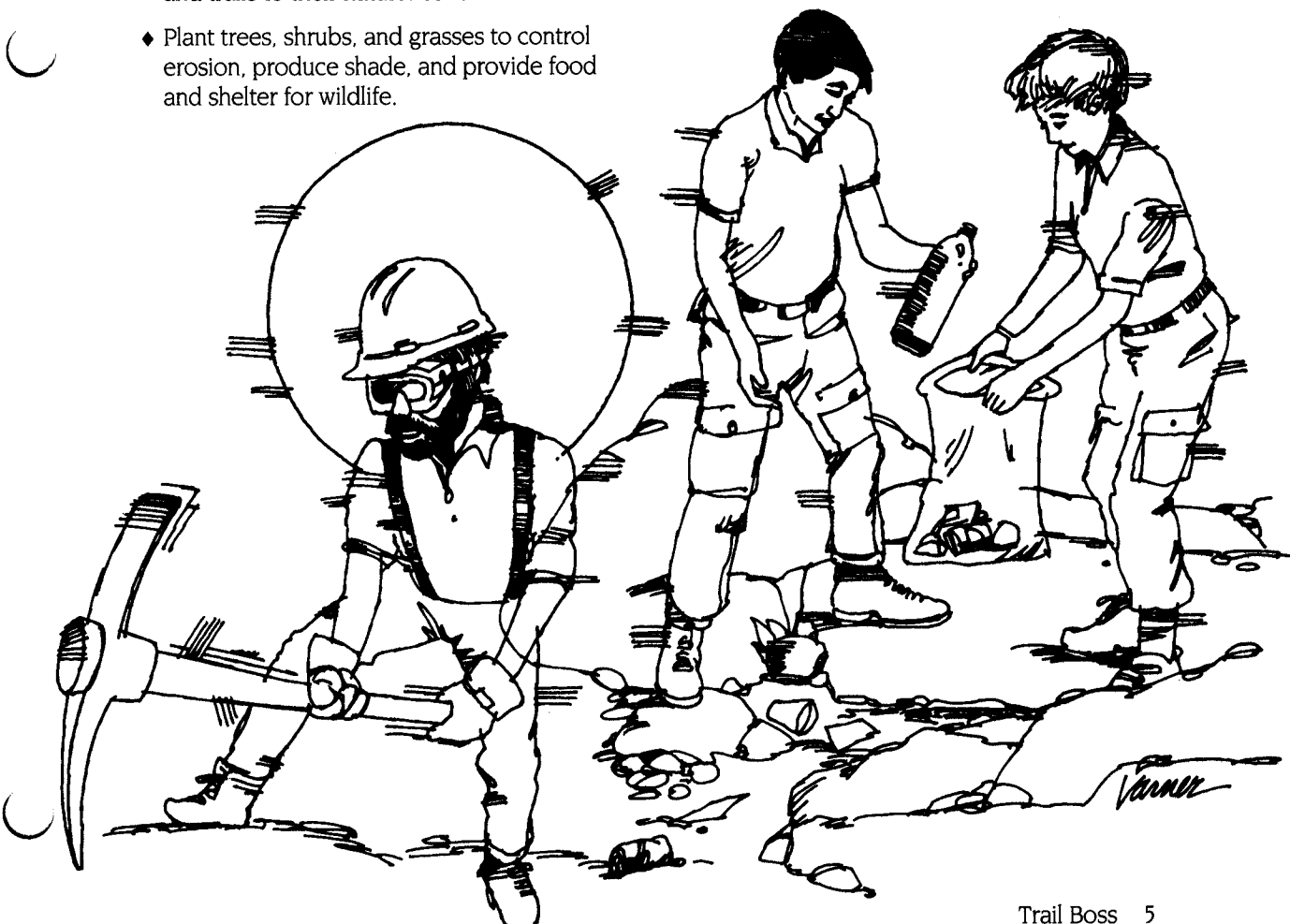
The first projects directed by prospective TRAIL Bosses should be short and simple. That will allow resource managers to see what a



particular group of volunteers can do. It also will increase the confidence of new TRAIL Bosses and enhance their ability to supervise work on projects of greater scope and complexity.

Over the years, volunteer groups have completed a tremendous amount of worthwhile conservation work. The following list suggests the variety and importance of what volunteers under TRAIL Boss leadership can do:

- ◆ Improve fish and wildlife habitat, riparian areas, streams, and shorelines.
- ◆ Construct and set up nesting boxes and feeders for waterfowl and other wild birds.
- ◆ Build structures in arid regions to hold water for wild animals.
- ◆ Conduct measurements of snow depth at backcountry monitoring locations and forward the information to meteorological stations.
- ◆ Stabilize threatened streambanks with riprap or gabions.
- ◆ Revegetate damaged meadows and hillsides.
- ◆ Return unwanted and abandoned campsites and trails to their natural conditions.
- ◆ Plant trees, shrubs, and grasses to control erosion, produce shade, and provide food and shelter for wildlife.
- ◆ Remove exotic plant species and restore native vegetation.
- ◆ Monitor the quality of streams.
- ◆ Conduct an ongoing census of selected wild animals.
- ◆ Maintain picnic pavilions, lifeguard towers, boat docks, playground equipment, and other outdoor recreational facilities.
- ◆ Prepare and install educational signs along nature trails.
- ◆ Build fences to prevent the overgrazing of riparian areas.
- ◆ Establish and care for urban greenbelts, neighborhood parks, or other open spaces.
- ◆ Clean up urban waterways, paint DUMP NO WASTE/DRAINS TO STREAM on storm drains, and distribute informational fliers that outline appropriate ways to dispose of oil, chemicals, and other toxic wastes.
- ◆ Help fisheries officials stock lakes and streams.



- ◆ Collect discarded Christmas trees and install them as revetments to protect streambanks or submerge them to provide shelter for fish.
- ◆ Build observation decks and blinds in wildlife refuges.
- ◆ Develop and maintain outdoor classroom sites.
- ◆ Clean and repair statues, gravestones, and other historic monuments.
- ◆ Restore historic buildings.
- ◆ Inventory significant landmarks and develop documentation to nominate sites to the National Register of Historic Places.
- ◆ Prepare and present research about the people and events important to the heritage of an area.
- ◆ Assist archaeologists in protecting and studying archaeological sites.
- ◆ Develop interpretive demonstrations, tours, and living history exhibits in resource areas and help present them to visitors.
- ◆ Increase accessibility of resource area facilities for disabled visitors.
- ◆ Upgrade, maintain, and help construct trails for hikers, horseback riders, bicyclers, and other users.
- ◆ Teach environmental awareness skills to young people visiting resource areas.
- ◆ Provide training in appropriate camping, hiking, and other recreational skills that are easy on the land.
- ◆ Prepare informational brochures to be distributed at agency visitor centers.
- ◆ Offer conservation-oriented presentations and slide shows to youth organizations and civic groups.
- ◆ Train others in appropriate conservation work skills.

TWO VIEWS OF TRAIL BOSS

- ◆ Our nation is full of people eager to care for the environment. They are of all ages and all backgrounds. They live everywhere—in cities, suburbs, and small towns, and on farms and ranches.

Every day they hear warnings that the environment is in trouble. They see pollution in the air and water. They see the trash filling landfills and the erosion of urban and agricultural land. Media reports bring distressing environmental news from around the globe.

People want to make things better. They want to roll up their sleeves and do something of value to heal and protect the environment. They want an active role in caring for the world in which they live.

- ◆ Conservation professionals entrusted to manage America's public and private lands and waterways often struggle under the burdens of too little funding and too much work. Even the most dedicated staffs overseeing city, state, and national resources seldom can protect the environment as completely as they would like.

As a result, many stream cleanup, meadow revegetation, erosion control, and wildlife habitat improvement projects must be left undone. Monitoring of resource areas used by humans and wildlife is too often delayed or never begun. Without occasional attention, forests, marshes, and lakeshores can suffer from erosion and abuse. Neglected campgrounds, beaches, monuments, recreational facilities, historic buildings, and trails will fall into disrepair. Researching history, designing displays and signs, writing about the environment, and dozens of other conservation-related activities may never occur.

In short, there is plenty of work to be done and there are plenty of volunteers eager to do it. TRAIL Boss is a tool that can connect the volunteers and leaders who want to do conservation projects with the resource managers who have conservation work to be done.

TRAIL BOSS HISTORY

The goal of TRAIL Boss is to train leaders so they can direct volunteers in conservation efforts. It is an idea with roots deep in America's relationship to the land.

The early identification of parks, forests, wildlife refuges, and waterways as part of the civic trust carried with it the understanding that all citizens would help shoulder the responsibility of caring for those areas. Americans have done that in two ways:

- ◆ By entrusting agencies to manage and conserve public and private lands in the best interests of everyone

- ◆ By playing a personal role in caring for the environment

TRAIL Boss grows out of both aspects of environmental stewardship. Today, hundreds of groups, from youth organizations to senior citizens' clubs, are undertaking conservation projects in cities and suburbs, on farms, and in parks and forests across the country.

An exciting example of volunteer stewardship of the environment is the TRAIL Boss work being done in southern California's Angeles National Forest. In 1971, Boy Scout leaders from the Los Angeles Area Council discovered that some of their favorite campsites were being closed because they were falling into disrepair. The Forest Service agreed to keep the sites open if the Scouts would restore and maintain them. The project was successful not only in making the sites usable, but also in providing a way for the Scouts to give something back to the land they treasured.

Angeles National Forest managers quickly realized the value of training the leaders of volunteer groups to oversee conservation work. Agency personnel joined with experienced Scouters to host training sessions so that leaders of any organization could gain the skills and experience to supervise their own groups engaged in conservation projects of all sorts.

Today, the TRAIL Boss idea is embraced by volunteers from groups as diverse as the Jet Propulsion Laboratory and the Mt. Wilson Bicycling Association. Boy Scouts are still involved, too. Scouts have provided more than 200,000 hours of volunteer service to the Angeles National Forest in the last 20 years. The kinds of projects TRAIL Bosses can supervise also are growing—everything from wildlife habitat enhancement, revegetation, and timber stand improvement to historical research and increasing the environmental awareness of national forest visitors.

To become a TRAIL Boss qualified by the Angeles National Forest to supervise volunteers undertaking conservation projects on agency lands, leaders receive several days of training from experienced TRAIL Bosses or United States Forest Service professionals. In addition to teaching the skills needed for the actual work, instructors discuss issues of group supervision, motivation, and safety.

With guidance from experienced TRAIL Bosses or Forest Service trainers, aspiring TRAIL Bosses validate their new abilities by guiding their groups in planning and carrying

out three work projects. At the end of the trial period, the new TRAIL Bosses are certified to lead projects on their own.

Agency personnel know that volunteers led by TRAIL Bosses can be trusted to do conservation work that meets agency standards. The Forest Service also realizes that TRAIL Bosses and their volunteers are interested in long-term commitments to conservation projects. The time the agency is devoting to training TRAIL Bosses is being richly returned.

WHAT TRAIL BOSS COSTS

TRAIL Boss requires no financial investment. To benefit from TRAIL Boss, however, all those involved must give something of themselves:

- ◆ Group leaders must be willing to seek out the training and experience they require to direct conservation work effectively. They also must devote time to planning projects and evaluating completed work.
- ◆ Resource managers need to contribute staff time to help leaders of volunteer groups master what they should know. Staff should help plan projects that take advantage of volunteers' skills.
- ◆ Volunteers must be willing to learn, to work hard, and to make a commitment to enhancing the environment.

THE REWARDS OF TRAIL BOSS

In almost every case, the rewards of becoming involved in TRAIL Boss far outweigh the effort:

For Resource Managers

- ◆ Most resource managers have conservation work they are unable to complete due to lack of money or personnel. Partnerships with volunteers working under TRAIL Boss leaders allow conservation professionals to accomplish more in the field, especially on projects that may require more time or personnel than resource managers normally have at their disposal.
- ◆ Groups led by TRAIL Bosses require a minimum of supervision by resource management staff. Agency personnel may need to meet

with TRAIL Boss leaders to plan projects and to provide standards and guidance for the satisfactory completion of the work. Tools and construction materials also may be the responsibility of the resource manager, as well as evaluation to help groups effectively assume future projects. However, the involvement of conservation professionals in doing the actual work can be minimal.

- ♦ Volunteers working on public and private lands learn about the people who manage those areas—their responsibilities, the difficulties they face, and the pleasures of their duties. That awareness can increase the public appreciation of professional conservation staffs and the work they do.

For Leaders of Volunteers

- ♦ Leaders becoming TRAIL Bosses gain the experience to plan and direct conservation activities for their groups. They acquire the foundation of a storehouse of work-skills knowledge that will increase each time they go into the field.
- ♦ Conservation projects give leaders opportunities to make environmental education come alive. Through their actions and enthusiasm, TRAIL Bosses can act as role models demonstrating a wise, hands-on approach to caring for the environment.
- ♦ TRAIL Bosses have the satisfaction of interacting with others interested in conservation and of building productive relationships with resource managers.

For Volunteers

- ♦ Volunteers who help to protect and enhance the environment learn how to accept responsibility. Rather than assuming they have no power to solve problems they see around them, they become active stewards of the land. The long-term effects of that awareness may be as valuable to the environment as the projects that volunteers complete.
- ♦ Taking part in conservation projects led by TRAIL Bosses can be terrific fun. No matter what a person's age, gender, or background, TRAIL Boss gives volunteers opportunities to work with old and new friends, learn useful skills, and feel a sense of accomplishment.

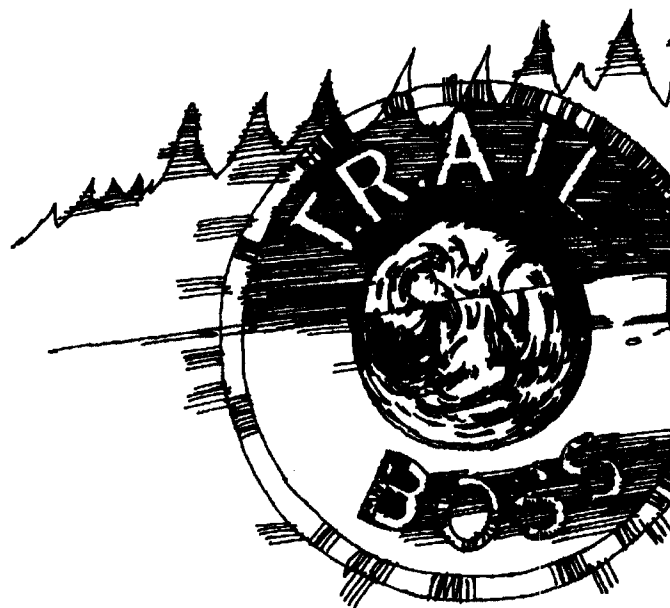
Good for volunteers, good for leaders, good for resource managers—TRAIL Boss holds promise for everyone involved. By addressing environmental problems with the hands and minds of enthusiastic volunteers and leaders, the concept also is good for the Earth.

TRAIL BOSS REQUIREMENTS

To be recognized as TRAIL Bosses, group leaders should do the following:

Explore Opportunities

1. Assess your group's interest in and capabilities for doing conservation projects. (See chapter 1, Group Assessment.)
2. Identify the agencies or organizations in your area that are interested in involving volunteers in conservation projects. (See chapter 2, Resource Management Agencies and Organizations.)
3. Contact agencies and organizations to explore project possibilities. (See chapter 3, Partnerships.)



Gain TRAIL Boss Skills

4. Learn about the following skills by reading the recommended resource materials and/or participating in a TRAIL Boss skills training course:

Environmental Awareness Skills (See chapter 4, Environmental Awareness.)

People Skills (See chapter 5, Leadership; and chapter 6, Safety.)

Administrative Skills (See chapter 7, Project Selection; and chapter 8, Evaluation.)

Work Skills (See chapters 9–14.)

6. Select, plan, and carry out two more conservation projects. These should provide further opportunities for increasing the work skills and environmental awareness of your group.

Upon fulfilling the requirements, group leaders may receive TRAIL Boss patches from cooperating agencies and conservation organizations. Building upon their training experiences, they can continue to provide increasingly effective leadership for volunteers in important conservation work. That's the real reward of TRAIL Boss—the beginning of months and years of productive partnerships leading to the completion of many environmental projects.

Put Your Knowledge to Use

5. In cooperation with an agency or organization, select, plan, and carry out a project that is within the skill level of you and your group. Evaluate the results.





1. Group Assessment

TRAIL Boss requirement No. 1:

Assess your group's interest in and capabilities for doing conservation projects.

The first step for involving a volunteer group in conservation work is to determine whether group members are interested and, if they are, what they may be capable of doing. The following questions can help with that assessment:

What does your group like to do?

Conservation projects can increase the pleasure of many activities. Fishing enthusiasts, canoers, kayakers, and rafters often are eager to improve the water quality of the lakes and streams they use. Bird-watchers might want to enrich wildlife habitat by planting hedges, trees, and grasses.

Hikers, bicyclists, and horseback riders may want to repair the trails on which they travel. Curiosity about the past can inspire group members to recondition monuments, cemeteries, and historic buildings. Others may be interested in caring for favorite urban greenbelts, parks, picnic grounds, and beaches. A love of discovery may lead volunteers to study and document changes in soil, plants, wildlife, and other aspects of ecosystems.

Many outdoor activities can be tailored to include environmental work. Hiking, camping, and canoeing trips, for example, may take group members to locations needing erosion control and revegetation. Conservation projects also can offer the social pleasure of planning and doing something worthwhile with friends and the enjoyment of meeting resource managers and other land users.

What are the abilities of group members?

Some people are ready to pull on their gloves and throw themselves into hard physical labor. Others may be more interested in compiling records in historical libraries and conservation offices, caring for plants in seedbeds, or developing environmental

education activities to enliven a group's conservation outings.

Carefully consider the abilities of group members, but don't sell anyone short. Every person who is motivated can add something to an environmental project. Remember, too, that people often welcome the challenge of attempting something a little beyond what they have achieved before.

How many participants can be expected to take part in conservation efforts?

Estimating the number of group members who will participate in conservation work will help you and resource managers determine appropriate sorts of projects and what reasonably may be accomplished.

How much time are people willing to devote?

If group members are enthusiastic about conservation work, discuss with them the amount of time they want to commit to planning and completing projects. Encourage them to be realistic. Families, jobs, schoolwork, and other responsibilities all take time.

The first conservation projects should be of short duration, usually no more than part of a day. That will give group members a chance to become familiar with what is expected of them and how much they can do. As they gain experience and increase their skills, they may want to adjust their schedules so they can contribute more time to the environment.

How will volunteers get to conservation project sites?

Group members may be able to reach work locations in their neighborhoods by walking. In urban areas, public transportation may be the answer. Sometimes groups can use canoes or bicycles for traveling to work sites, or rely upon private automobiles.

Design a practical transportation plan with your group. Will vehicles be available when and where they are needed? If drivers are required, who will they be?

Do participants have access to work clothing and personal gear?

Conservation work can be muddy, wet, and hard on clothes. Volunteers may need sturdy clothing that will keep them warm or cool as the weather demands. They may need clothing to protect them from insects and brush. Work gloves are important for many projects, as are sturdy boots. Water bottles and rain gear often add to the comfort and safety of environmental tasks.

Does your organization have policies regarding group travel and involvement in work projects?

Before sanctioning the activities of its members, many organizations require that group leaders fill out forms and establish safety guidelines. Early in the process of planning conservation work, check your organization's policies and address any concerns that may affect your group's plans.

How many group leaders want to become involved?

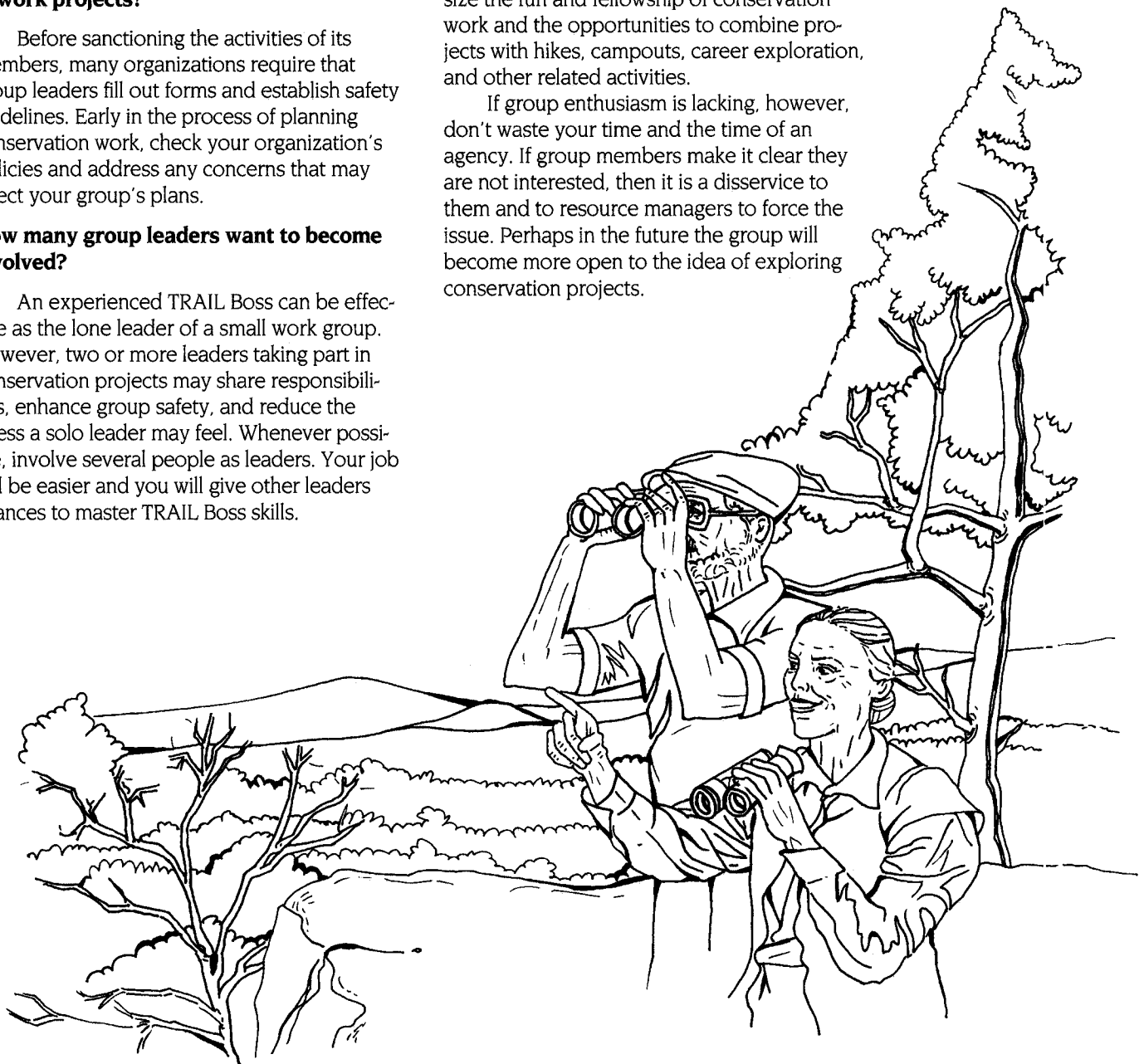
An experienced TRAIL Boss can be effective as the lone leader of a small work group. However, two or more leaders taking part in conservation projects may share responsibilities, enhance group safety, and reduce the stress a solo leader may feel. Whenever possible, involve several people as leaders. Your job will be easier and you will give other leaders chances to master TRAIL Boss skills.

Are people in your group really interested in doing conservation projects?

As you consider the responses to the questions above, be honest with yourself about the degree of enthusiasm (or the lack of it) group members express for volunteering to do conservation work. It is frustrating for group leaders and agency staff to invest time and energy in planning projects, only to discover that the volunteers would rather be doing something else.

A group's reluctance to participate in conservation projects may stem from inexperience with such work and doubts about what will be expected. You can encourage the group to get a taste of environmental work by helping it plan and complete a project of a few hours that is assured of success. You also can emphasize the fun and fellowship of conservation work and the opportunities to combine projects with hikes, campouts, career exploration, and other related activities.

If group enthusiasm is lacking, however, don't waste your time and the time of an agency. If group members make it clear they are not interested, then it is a disservice to them and to resource managers to force the issue. Perhaps in the future the group will become more open to the idea of exploring conservation projects.



2. Resource Management Agencies and Organizations

TRAIL Boss requirement No. 2:

Identify the agencies or organizations in your area that are interested in involving volunteers in conservation projects.

HOW VOLUNTEERS CAN FIND RESOURCE MANAGERS

Does your group enjoy spending time in parks, forests, at lakeshores, or on ocean beaches? Are you near a public arboretum, fish hatchery, wildlife refuge, or bird sanctuary? Are there greenbelts and waterways in your neighborhood? When you visit such areas, find out whom to talk to about involving volunteers in worthwhile projects. The agency or management organization may have a coordinator of volunteer activities. If not, ask who is in charge of the area and how you can make contact.

Local libraries will have information about agencies and conservation organizations operating in your area. A reference librarian can explain the process of finding useful material.

If you live near a college or university, its departments of ecology, forestry, and outdoor recreation may be able to direct you to conservation opportunities. Check also with campus clubs whose members are interested in archaeology, local history, camping, caving, mountaineering, river running, ecology, wildlife study, community service, and similar pursuits.

The telephone book may be the most valuable guide for discovering conservation possibilities. Listings include all federal, state, and local agencies and many conservation-oriented organizations. Calling the offices closest to you may launch your search for a meaningful partnership with conservation professionals.

HOW AGENCIES AND CONSERVATION ORGANIZATIONS CAN FIND VOLUNTEERS

Resource managers who want to encourage volunteer involvement in conservation work can follow many avenues to contact interested

groups and individuals. Libraries and telephone books often provide good leads, as can listings of campus organizations at universities and colleges.

Perhaps the most productive method is also the simplest. Notice what groups are using the lands and waterways you manage. Talk with them to learn about each group's interests and abilities. If they want to learn more about undertaking projects that will enhance the resources they use, arrange a time to meet with group leaders to discuss TRAIL Boss and to explore the project opportunities available. You may find they are very open to helping care for the areas they enjoy.

WHO ARE RESOURCE MANAGERS?

State, County, and City Agencies

States, counties, and cities all have agencies dedicated to managing natural and historical resources within their jurisdictions. Their names indicate the scope of their responsibilities—for example, departments of ecology, state parks departments, county forestry commissions, game management agencies, soil conservation districts, state offices of archaeology, departments of natural resources, and city offices of parks and recreation.

Many of these agencies involve volunteer groups in projects on public and private lands. Others will guide groups interested in recycling programs and related efforts that can enrich communities.

FEDERAL AGENCIES

The agencies administering the largest expanses of public lands are those of the federal government. They include the following:



BUREAU OF LAND MANAGEMENT (BLM)

Bureau of Land Management
U.S. Department of Interior
18th and C Streets, NW, Room 5600
Washington, DC 20240

The jurisdictions of the Bureau of Land Management encompass rugged desert landscapes, evergreen forests, snowcapped mountains, and abundant wildlife. Covering more than 272 million acres—almost half of all federally owned lands—BLM areas are managed under multiple-use principles that support outdoor recreation, fish and wildlife production, livestock grazing, timber harvesting, industrial development, watershed protection, and onshore mineral production.

Outdoor recreation is allowed in most BLM areas. In cooperation with BLM personnel, volunteer groups have completed significant work enhancing waterways, trails, and camping areas.



U.S. ARMY CORPS OF ENGINEERS

Office of Public Affairs
U.S. Army Corps of Engineers
200 Massachusetts Avenue, NW
Washington, DC 20314

The Corps of Engineers in the Department of the Army was established to serve construction needs of America's military forces. The Corps also has built many of America's harbors and waterways. Reservoirs behind dams constructed by the Corps are recreational retreats for many Americans.

The Corps strives to maintain and create conditions under which the human and natural environments can exist in productive harmony.

Projects are designed with the intent of preserving important historic and archaeological resources. Volunteer groups have completed significant conservation work to improve shorelines, waterways, and recreational facilities within Corps of Engineers areas.



ENVIRONMENTAL PROTECTION AGENCY (EPA)

Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

The Environmental Protection Agency implements federal laws designed to protect the environment. Established in 1970 as an independent agency in the executive branch of the federal government, the EPA helps Americans maintain clean air, water, and land and prevent pollution that can cause future damage to the environment.

The Agency works to protect every aspect of our nation's environment by aggressively pursuing source reduction and recycling as an integral part of all its mandated regulation and control activities. One of its goals is the reduction of household hazardous waste through state and local recycling programs.

EPA personnel are valuable sources of information for volunteers interested in developing workable recycling programs in their neighborhoods and for those seeking to become actively involved in cleaning up their community's air, land, and water. EPA resources also can enrich an organization's environmental education efforts.



U.S. FISH AND WILDLIFE SERVICE (FWS)

Fish and Wildlife Service
Assistant Director for Fish and Wildlife Enhancement
U.S. Department of the Interior
18th and C Streets, NW, Room 3020
Washington, DC 20240

From the Arctic Ocean to the South Pacific and from Maine to the Caribbean, the Fish and Wildlife Service manages nearly 500 national wildlife refuges. Varying in size from half-acre parcels to thousands of square miles, the refuges encompass more than 90 million acres of the nation's wildlife habitats. These areas make up the world's largest and most diverse collection of lands set aside specifically for wildlife.

The mission of the Fish and Wildlife Service is to conserve, protect, and enhance fish, wildlife, and their habitats for the benefit of the American people. While the agency is dedicated to the preservation of all wildlife, its primary responsibilities are for migratory birds, endangered species, freshwater and migratory fisheries, and certain marine mammals.

The Service sets migratory bird hunting regulations, leads efforts to restore endangered animals and plants, and administers a nationwide network of law enforcement agents. Volunteers have helped the FWS enhance wildlife habitat, monitor animal activity, and conduct biological studies.



U.S. FOREST SERVICE (USFS)

U.S. Forest Service
Department of Agriculture
P.O. Box 96090
Washington, DC 20013-6090

Gifford Pinchot, the first chief of the Forest Service, stated the guiding principle of the agency as "the greatest good to the greatest number in the long run." For many decades, national forests have served public interests including harvesting resources and developing recreational opportunities. Parts of some forests are set aside as wilderness areas to preserve the unspoiled quality of the environment.

The agency is divided into nine regions serving various parts of the country. Each regional office oversees the activities in its forests, which are further divided into districts directed by district rangers. Volunteers are most likely to work with Forest Service personnel at the district level.

The Forest Service manages nearly 200 million acres of America's forests and rangelands, including 156 national forests, 83 experimental forests and ranges, 19 grasslands, and 16 land utilization projects. The Forest Service also conducts research to find better ways to manage and use national resources and helps private landowners adopt good forest practices.



NATIONAL PARK SERVICE (NPS)

National Park Service
U.S. Department of Interior
P.O. Box 37127
Washington, DC 20013-7127

Established in 1916, the National Park Service is directed by Congress "... to promote and regulate the use of the national parks, monuments, and reservations ... to conserve the scenery and the natural and historic objects and the wildlife therein ... by such means as will leave them unimpaired for the enjoyment of future generations."

Besides protecting natural resources, the National Park Service strives to give the public opportunities for camping, backcountry exploration, hiking, horseback riding, swimming, boating, cross-country skiing, and the study of nature and American history. Volunteers are encouraged to become involved in appropriate park care and management efforts.

The Park Service administers 337 areas that include 79 million acres of the nation's natural, historical, and cultural heritage. National parks, national recreation areas, national monuments, or national seashores can be found in almost every state in the Union as well as Guam, Puerto Rico, and the Virgin Islands.



SOIL CONSERVATION SERVICE (SCS)

Soil Conservation Service
U.S. Department of Agriculture
P.O. Box 2890
Washington, DC 20013

The Soil Conservation Service helps individuals, organizations, cities and towns, and county and state governments reduce the costly waste of land and water resources and put these national assets to good use. The guiding principle is that the use and conservation of the land be in harmony with its capabilities and needs. The SCS fulfills that principle by providing technical help and, sometimes, financial aid for soil and water conservation, natural resource surveys, and community resource protection and management.

SCS's nationwide network of conservation specialists helps people understand and protect land and water resources while using them in beneficial ways. The SCS staff includes soil conservationists, engineers, archaeologists, scientists, agronomists, biologists, economists, foresters, geologists, landscape architects, cartographers, and specialists in plant materials, recreation, and the environment. TRAIL Bosses can draw upon their expertise by contacting any of the nearly 3,000 locally organized and operated SCS conservation districts in the United States.



BUREAU OF RECLAMATION

Bureau of Reclamation
Public Affairs Office, BLM
U.S. Department of Interior
1849 C Street, NW, Mail Stop #7644
Washington, DC 20240

The Bureau of Reclamation was created in 1902 to reclaim arid lands in 17 western states. Projects of the Bureau supply water to more than 10 million acres of land. Other work of

the Bureau includes providing municipal and industrial water, hydroelectric power, and recreational opportunities and enhancing fish and wildlife habitat.

CONSERVATION AGENCIES

Many organizations encourage volunteers to undertake conservation projects. Some direct their efforts toward a particular kind of work such as the improvement of wildlife habitat, or concentrate their activities in certain geographic areas. Other organizations are more general in their approach and national in scope.

The organizations described in this section represent a sampling of a large network of conservation-oriented groups able to help volunteers find ways to care for the environment. Many can help guide TRAIL Bosses in involving their groups in conservation projects. Conservation professionals and resource managers also may draw upon them as pools of potential TRAIL Boss leaders and volunteers.

AMERICAN FORESTRY ASSOCIATION

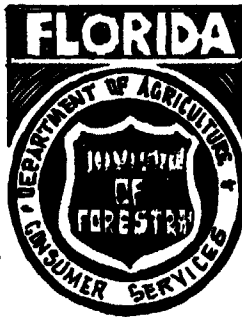
American Forestry Association
1516 P Street, NW
Washington, DC 20005
202-667-3300

Created in 1875, the American Forestry Association seeks to advance intelligent management and use of forests, soil, water, wildlife, and all other natural resources. To that end, the Association seeks to create an enlightened public appreciation of these resources and the part they play in the social and economic life of the nation.

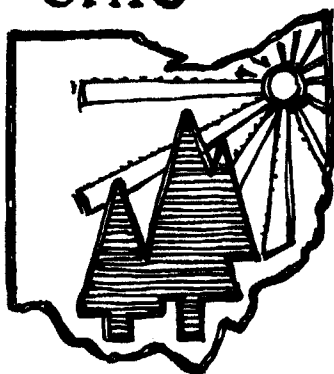
AMERICAN HIKING SOCIETY

American Hiking Society
1015 31st Street, NW
Washington, DC 20007
703-385-3252

American Hiking Society (AHS) promotes the interests of hikers and helps preserve the trails on which they walk. Through work trips and a yearly directory of volunteer opportunities on public lands titled *Helping Out in the Outdoors*, the organization encourages hikers to become involved in a wide range of conservation projects.



OHIO



UTAH
RESOURCES
CREATION



APPALACHIAN TRAIL CONFERENCE

Appalachian Trail Conference
Box 807
Harpers Ferry, WV 25425
304-535-6331

The Appalachian Trail is one of America's recreational treasures. Wandering 2,100 mountainous miles from central Maine to northern Georgia, much of the trail was built by volunteers. Today, volunteers clear the trail of brush, maintain the tread, and repair campsites and shelters. The 32 hiking clubs that make up the Appalachian Trail Conference encourage volunteers to join them for ongoing conservation projects along many footpaths in the eastern states.

BOY SCOUTS OF AMERICA

Boy Scouts of America
National Office
1325 West Walnut Hill Lane
P.O. Box 152079
Irving, Texas 75015-2079
214-580-2000

Founded in 1910, the Boy Scouts of America (BSA) has long been one of the nation's largest youth groups. BSA literature and training encourage all Scouts to use appropriate methods of low-impact and no-trace camping and hiking whenever they are on outings, and to do all they can to protect the environment.

Scout leaders who become trained, experienced TRAIL Bosses can lead Scout units in a wide range of conservation-oriented efforts. Scouts can be especially helpful in enhancing the condition of the many BSA camps scattered across America.

DUCKS UNLIMITED

Ducks Unlimited
One Waterfowl Way
Long Grove, IL 60047
708-438-4300

Ducks Unlimited exists to perpetuate waterfowl and other North American wildlife by preserving, restoring, and enhancing wetlands, nesting and wintering areas, and other wildlife habitats in Canada, the United States, and Mexico.

GIRL SCOUTS OF THE UNITED STATES OF AMERICA

Girl Scouts of the United States of America
830 Third Avenue
New York, NY 10022
212-940-7500

The Girl Scout organization provides opportunities that encourage personal growth through a wide variety of activities. Girl Scout goals include meaningful involvement in social action, environmental projects, wildlife values education, youth leadership, career exploration, and community service. Membership includes half a million adults and more than 2.5 million girls.

HUMAN ENVIRONMENT CENTER

Human Environment Center
1001 Connecticut Avenue, NW, Suite 827
Washington, DC 20036
202-331-8387

The Center provides technical assistance for youth conservation and service corps programs and helps minority environmental interns and professionals with job placement. By providing education and information, the Center promotes joint activities among environmental groups. Other concerns include urban parks and recreation and minority environmental issues.

IOWA NATURAL HERITAGE FOUNDATION

Iowa Natural Heritage Foundation
Insurance Exchange Building, Suite 1005
505 Fifth Avenue
Des Moines, IA 50309
515-288-1846

All states and many counties, townships, and urban areas have conservation organizations focusing their efforts upon their particular geographic areas. The Iowa Natural Heritage Foundation is an example of such a group.

Formed in 1979, the Foundation serves as a catalyst and facilitator in the preservation and protection of Iowa's natural resources. Programs of the Foundation emphasize land protection, resource education, and long-range planning and research.

THE IZAAK WALTON LEAGUE OF AMERICA, INC.

The Izaak Walton League of America, Inc.
1401 Wilson Boulevard, Level B
Arlington, VA 22209
703-528-1818

The Izaak Walton League encourages and educates the public to conserve, maintain, protect, and restore soil, water, air, and other natural resources. An example of the League's effectiveness is the Save Our Streams program (SOS), which teaches volunteers how to monitor and report the quality of streams.

NATIONAL ARBOR DAY FOUNDATION

National Arbor Day Foundation
100 Arbor Avenue
Nebraska City, NE 68410
402-474-5655

The National Arbor Day Foundation encourages the planting of trees through educational programs including Trees for America, Arbor Day, Tree City USA, and Conservation Trees. Publications offered by the Foundation can be of great help to TRAIL Bosses interested in making tree planting part of their programs.

NATIONAL ASSOCIATION OF SERVICE AND CONSERVATION CORPS

National Association of Service and Conservation Corps (NASCC)
1001 Connecticut Avenue, Suite 827
Washington, DC 20036
202-331-9647

Formed in 1985, NASCC is a nonprofit association of more than 60 conservation corps from across America. Besides serving as a clearinghouse of information for its members, NASCC actively promotes the formation and operation of youth conservation corps at federal, state, regional, county, and municipal levels. From members as large as the California Conservation Corps to the newest local programs in small cities across the nation, the organizations of NASCC use environmental work to give youth of many backgrounds work-skills training and meaningful job opportunities.

NATIONAL AUDUBON SOCIETY

National Audubon Society
950 Third Avenue
New York, NY 10022
212-832-3200

The National Audubon Society is deeply involved in the protection of the air, water, land, and habitat that are critical to our health and the health of the planet. With more than 600,000 members, the Society draws on the dedication and energy of many volunteers to help save threatened ecosystems.

NATIONAL EDUCATION ASSOCIATION

National Education Association (NEA)
1201 16th Street, NW
Washington, DC 20036
202-833-4000

The National Education Association works to promote the cause of education in the United States. Many of its members are deeply interested in enhancing environmental education for people of all ages, and to provide them with opportunities to care for the world around them.

NATIONAL PARKS AND CONSERVATION ASSOCIATION

National Parks and Conservation Association (NPCA)
1015 31st Street, NW
Washington, DC 20007
202-944-8530

This private, nonprofit organization's role is the preservation, promotion, and improvement of America's park system. The NPCA has focused on the health of the entire park system, from the improvement of specific sites to overall process of planning, management, and evaluation.

THE NATURE CONSERVANCY

The Nature Conservancy
1815 North Lynn Street
Arlington, VA 22209
703-841-5300

Managing over 1,100 nature sanctuaries, the Nature Conservancy is committed to preserving biological diversity by protecting natural lands and the life they harbor. The organization is eager to cooperate with educational institutions and both public and private conservation agencies.

NATIONAL WILDLIFE FEDERATION

National Wildlife Federation
1400 16th Street, NW
Washington, DC 20036-2266
202-797-6800

The Federation is a conservation education organization dedicated to creating and encouraging an awareness of the need for wise

use and proper management of the Earth's natural resources. Among its many activities, the organization publishes educational materials and sponsors outdoor education programs.

PACIFIC CREST TRAIL CONFERENCE

Pacific Crest Trail Conference
Box 820
Sisters, OR 97759
503-549-5441

Following the magnificent mountain ranges and deserts of Washington, Oregon, and California, the Pacific Crest Trail (PCT) runs 2,600 miles from the Canadian border to Mexico. The Pacific Crest Trail Conference is a recreation-oriented group of volunteers who realize that those who use the trail can also help care for it. Volunteer groups led by TRAIL Bosses perform regular trail maintenance along some sections of the PCT and address problems of storm damage, overgrowth, and erosion. A long-term objective of the Conference is to have every segment of the Pacific Crest Trail adopted by a dedicated group whose leaders have training like that offered by TRAIL Boss.

RAILS TO TRAILS CONSERVANCY

Rails to Trails Conservancy
1400 16th Street, NW, Suite 300
Washington, DC 20046
202-797-5400

The Rails to Trails Conservancy cooperates with local recreation and conservation organizations to convert abandoned railroad corridors into recreational trails. While much of the Conservancy's work involves land acquisition, the organization also encourages volunteers to help with the construction and maintenance of travelways.

SIERRA CLUB

Sierra Club
730 Polk Street
San Francisco, CA 94109
415-776-2211

Founded by naturalist John Muir to help everyone explore, enjoy, and protect the wild places of the earth, the Sierra Club promotes responsible use of the earth's ecosystems and resources, and enlists people in the protection

and restoration of the environment. Sierra Club service trips combine backcountry living with opportunities for volunteers to restore trails and repair damaged campsites.

STUDENT CONSERVATION ASSOCIATION

Student Conservation Association
Box 550
Charlestown, NH 03603
603-826-4301

The Student Conservation Association (SCA) High School Program gives students ages 16–18 expenses-paid opportunities to live for a month or more in small groups completing challenging conservation projects in the backcountry of parks and forests across America. The SCA Resource Assistant Program places volunteers ages 18 and over in 12-week internships with natural resource agencies. The SCA Wilderness Work Skills Program offers training in traditional and contemporary land management skills to TRAIL Bosses, agency professionals, conservation corps members, and others.

TREEPEOPLE

TreePeople
12601 Mulholland Drive
Beverly Hills, CA 90210
818-753-4600

By teaching individuals and groups how to plant and maintain trees, TreePeople emphasizes the importance of diverse groups working together for the common good. The organization also encourages volunteers to recognize the power they have to improve the environment.

TROUT UNLIMITED

Trout Unlimited
501 Church Street, NE
Vienna, VA 22180
703-281-1100

Trout Unlimited is an international conservation organization dedicated to the protection of clean water and the enhancement of trout, salmon, and steelhead fishery resources.

WILDERNESS SOCIETY

Wilderness Society
900 17th Street, NW
Washington, DC 20006
202-833-2300

The Wilderness Society is devoted to preserving wilderness and wildlife, protecting America's prime forests, parks, rivers, and shorelands, and fostering an American land ethic. The society encourages people to become involved in activities that promote these causes.

3. Partnerships

TRAIL Boss requirement No. 3:

Contact agencies and organizations to explore project possibilities.

THE VALUE OF A PARTNERSHIP

Volunteers eager to “do some conservation” sometimes approach resource managers without announcement on a Saturday morning and ask if they can do a project that day. Because they have done little advance planning on their own or with conservation professionals, those volunteers are unlikely to have a very satisfying experience.

Compare them with a group that has decided to include conservation work as a regular part of its program. Agency personnel who become acquainted with group members and know they are willing to plan ahead often will be enthusiastic about suggesting environmental projects with opportunities for learning, for service, and for fun.

Perhaps the most valuable part of a group’s long-term commitment to conservation is the sense of stewardship that volunteers can

develop. Over time, they can see that their efforts are making a difference in the quality of the world around them. They can come to understand that caring for the environment is as basic a part of their outdoor activities—and their lives—as camping, hiking, and other adventures already may be.

FORMING A PARTNERSHIP

An enduring partnership between a volunteer group and a land-management agency or organization will not happen overnight. Like a friendship, it probably will begin small. As each side becomes acquainted with the other and



builds a foundation of trust and understanding, the partnership should become increasingly strong. Such a relationship is an ideal setting in which volunteers can explore the environmental opportunities available to them and resource managers can learn the most effective ways to involve volunteers in conservation work.

The first meeting between group leaders and resource managers starts the process of discovering how to mesh the interests of volunteers with the needs of the cooperating agency or organization. TRAIL Bosses and volunteers can use the meeting to discover whether working with a particular resource manager is the best way to go. Agency staff with work that needs to be done can find out about volunteers' abilities, time considerations, and motivation for offering to help.

ARRANGING A MEETING

Once you have identified an agency or conservation organization you believe might be interested in involving your group in environmental work, call the local office and ask to speak to the person who can discuss volunteer opportunities. That may be a coordinator of volunteer activities, district conservationist, ranger, supervisor, or maintenance worker.

Explain that you want to arrange a time to visit for 20 to 30 minutes to discuss how your group might help complete conservation projects. Let the resource manager know how many people will be coming for the meeting and who they are. Keep the number small—one or two leaders and, at most, one or two other group members.

Follow up your call by sending the resource manager a note confirming the appointment, then telephone the day before the meeting to make sure the time is still convenient. Present the best possible impression by being on time for the meeting and knowing what you are doing there.

PREPARING FOR A MEETING

Before the meeting, consider what you want to learn from a resource manager and think about answers to questions you are likely to be asked. The following questionnaire, based on information from your group assessment, can help you organize your information.

Questions you should be prepared to answer about your group:

- ◆ What is the purpose of your group and what kinds of activities have members enjoyed in the past?
- ◆ What evidence is there that members want to undertake projects to help the environment?
- ◆ How much time are group members willing to dedicate to conservation work?
- ◆ What sorts of projects would your group like to do?
- ◆ Do group leaders have past experience working with a conservation professional? Do volunteers and their leaders already have work skills that could be of use in environmental projects?
- ◆ What geographical area is within range for the group?

Questions you might ask about the resource management agency or organization:

- ◆ Are conservation professionals accustomed to working with volunteers? What successes have they had in the past?
- ◆ What sorts of projects would resource managers like to accomplish if they had sufficient staff, particularly those efforts requiring labor-intensive work that is beyond the time limitations of current personnel?
- ◆ Would resource managers be interested in having your group involved in conservation work on a long-term basis (one weekend every month, for example), especially if group leaders can supervise work efforts and complete projects to agency standards?

Answers to these questions should make the first meeting between group leaders and management staff productive for everyone involved. In addition, group leaders can emphasize the following points:

- ◆ Rather than undertaking a one-time project, your group is interested in developing a long-lasting volunteer relationship with the resource management organization that can accomplish much environmental work.
- ◆ Through TRAIL Boss, group leaders are willing to learn the skills to provide most of the supervision their groups will require. That

can significantly reduce the amount of time conservation professionals must devote to overseeing volunteers working on projects.

- ◆ You and your group are eager to start with small, easily managed projects that will allow resource managers and your group to get to know one another, to learn what each expects, and to develop a productive partnership. Initial work that has a high likelihood of success and satisfaction will encourage volunteers and resource managers to cooperate on future environmental projects.

Consider inviting conservation professionals to visit a regular meeting of your organization. Seeing members in their own setting can help agency personnel better understand the nature of your group and the people who are involved

with it. Resource managers also can share information about their agency or organization and discuss possibilities for involving the group in conservation projects.

WHAT IF THE RESPONSE IS NOT ENCOURAGING?

Don't expect every attempt to approach an agency or conservation organization to be immediately successful. First meetings with staff are part of an exploration process. Sometimes that process leads to a dead end. The resource manager you contact might not have any projects appropriate for volunteers. There might have been unsatisfactory experiences with volunteer groups before you.



Agency personnel might feel they do not have time to involve the public in conservation efforts.

If certain resource managers seem unwilling to entertain the possibility of working with your group, don't give up without trying to understand their reluctance. Consider the following reasons (and the responses you can provide):

- ◆ The resource manager might be wary of taking on the additional responsibility of supervising volunteers.

(Emphasize that by starting with small projects, both the resource manager and the volunteer group can test a partnership on a limited scale. Leaders gaining TRAIL Boss experience can do much of the supervision, eventually relying on conservation professionals only for a project's initial guidelines and for evaluation of completed work. Rather than being a hindrance, TRAIL Boss groups can help a resource manager complete much important work that staff might not otherwise have time to address.)

- ◆ Resource managers might feel they have no projects that would be of interest to your group or that would fall within the skill levels of volunteers.

(While sometimes true, more often the management staff is not aware of the broad range of projects that volunteers are capable of doing. Encourage resource professionals to review the list of projects in the introduction to this manual and the work skills described in later chapters. This material might suggest possibilities they haven't considered.)

- ◆ You have not yet found the right person to work with in the agency or organization.

(Try to speak with someone more inclined to explore work opportunities for your group.)

Despite your best efforts, you might be unable to make headway with particular resource managers. In such cases, turn your attentions elsewhere. Renew your search by seeking out other agencies and conservation organizations.

Groups sincerely interested in providing volunteer care for the environment eventually will find conservation professionals pleased to work with them. When you connect with people who appreciate what you and your group have to offer, your volunteers and those resource managers will have the beginnings of a long, productive, and positive relationship.



4. Environmental Awareness

The choices we make as individuals and as a society profoundly affect our environment. Every day, we decide how to dispose of wastes, whether to recycle, what to purchase, where to live, and what to eat. As citizens, we can choose to play a role in determining the local, state, and federal regulations that govern the uses of America's natural resources and public lands.

Conservation work also involves choices. Whatever the projects—planting vegetation, preventing erosion, increasing the survival rates of certain species—the choices made by resource managers and volunteers will have immediate and long-term effects upon the environment.

The more we know about the environment, the greater our ability to care for it by making wise choices. Conservation projects provide ideal settings for people to enjoy,

explore, and appreciate the world around them and to develop a strong sense of responsible stewardship of the land.

TEACHING ENVIRONMENTAL AWARENESS

You don't need a scientific background to help others get excited about the wonders and complexities of the environment. What you do need is an eagerness simply to learn about what you see, hear, smell, and feel. By sharing that enthusiasm, you can encourage others to use their own senses to observe their surroundings, too. Emphasize what you do know about the environment and open yourself to discovery. People are likely to respond positively to your willingness to learn along with them.



TRAIL Bosses have many resources they can draw upon to make environmental awareness an essential part of conservation work. Group members may be willing to share what they've learned from previous environmental education opportunities. Others may know something about nature from school, occupational training, and their own observations. They often will be pleased to offer information on weather patterns, plant species, animal activities, and hundreds of other subjects. Their knowledge need not be scientific to be of value. Looking, thinking, and discussing are of greater importance.

As you plan conservation work, invite resource managers to share their expertise with your group sometime during the day of a project. Park rangers, forest biologists, marine researchers, maintenance supervisors—nearly everyone has something of interest to contribute to volunteers' understanding and enjoyment of the areas in which they are working.

Your group may want to assemble a library of books about plants, birds, insects, marine life, soil, weather, and other aspects of the environment. Group members can use the books to enrich their awareness before or during conservation projects.

to trace the stream to its origins in a watershed, or to its destination in a river, lake, or sea. Someone in the group might be able to explain the cycle of evaporation and precipitation that replenishes streams.

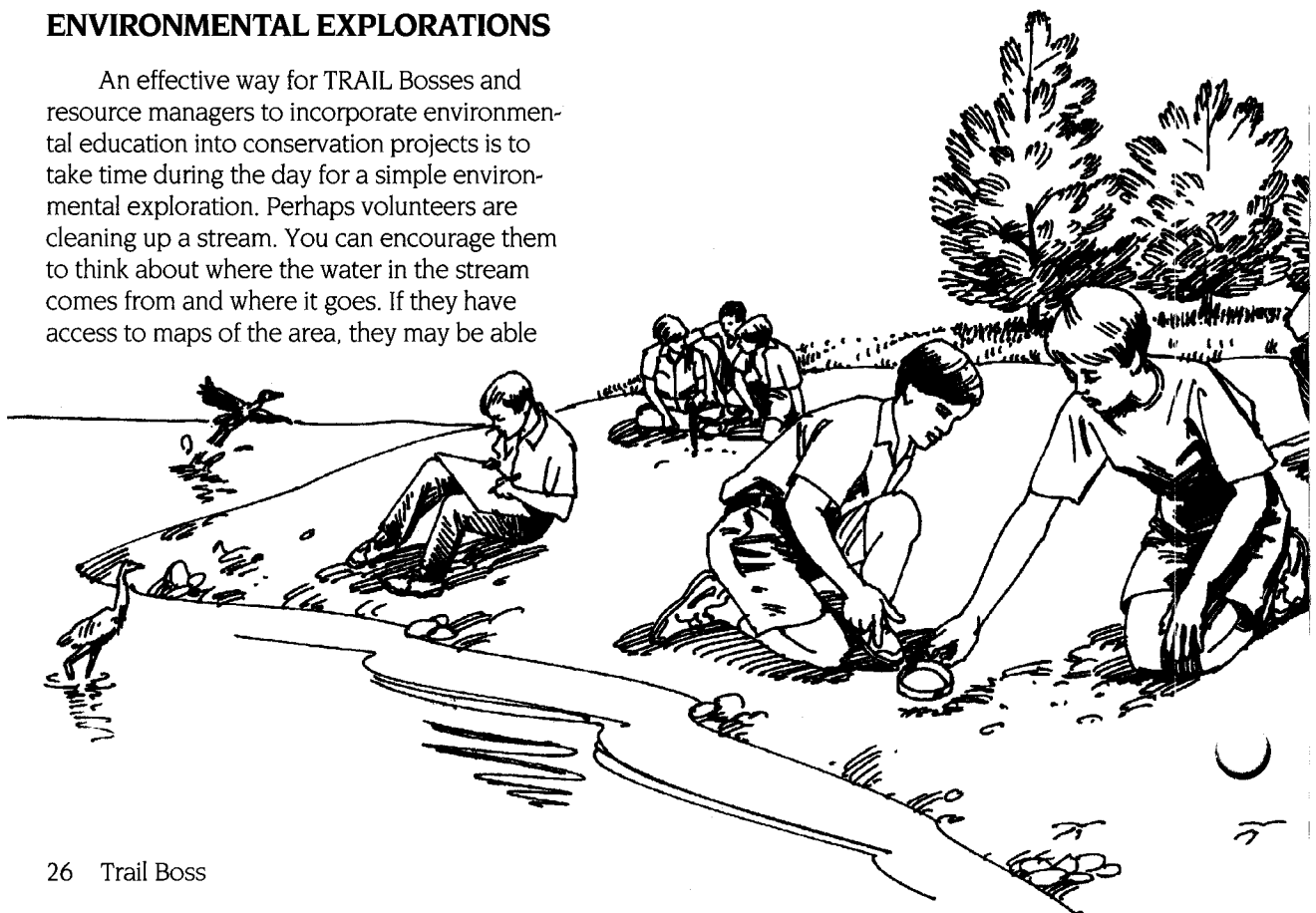
Suggest that group members consider how human activities affect the waterway. What might the area have looked like 50, 100, or 500 years ago? Is there evidence that the stream is currently being used for recreation, drinking water, manufacturing, irrigation, transportation, or sewage disposal? What effects do those uses have upon the quality and quantity of the water?

Invite people to feel the soil near the stream. Is it dry or moist? What color is it? What makes it that color? Does it have an aroma? If so, why? Dig a few inches into the earth and see if the deeper soil is different from that on top. What evidence is there of organisms living in the soil?

What plants are found in and near the stream? How do they differ from vegetation growing some distance from the water? Why are plants bigger near the water? Do the shapes of the plants help them survive in the places where they grow? How is vegetation being affected by activities of livestock, wild animals, and humans?

ENVIRONMENTAL EXPLORATIONS

An effective way for TRAIL Bosses and resource managers to incorporate environmental education into conservation projects is to take time during the day for a simple environmental exploration. Perhaps volunteers are cleaning up a stream. You can encourage them to think about where the water in the stream comes from and where it goes. If they have access to maps of the area, they may be able



Consider how trees and other plants get their food and water. Does vegetation growing in shaded areas differ from that in bright sunlight? Crush a leaf between your fingers. Smell it and describe the aroma. Are any parts of the plants eaten by animals? How might animals provide nutrition for plants?

Sit quietly for a few minutes and listen. What sounds can you hear that are made by humans? What natural sounds? Try to mimic the songs of birds. Make a map of the sources of the noises in the area.

What kinds of animals live in and around the stream? Look closely for tracks, nests, and other signs in the grass, under bushes, on the bark of trees, in the water and the soil. Use a magnifying glass for closeup views of insects and other small creatures and binoculars for birds and other animals farther away.

Provide paper and pencils and urge group members to list all the animals or animal signs they find. Suggest they draw pictures of some of the animals and sketch a rough map of where different animals live. Help group members learn more about the animals by assisting them in looking up information in a nature guide.

How do fish, birds, amphibians, insects, mammals, and microscopic organisms use

the stream and the land around it? What do they eat? Where do they find shelter? What must they do to survive cold, heat, and other seasonal changes? What human activities affect wildlife?

Follow an insect, bird, or small mammal as it moves. What is it doing? Get down close to the earth for an insect's view of the world. Climb a tree and look at the stream the way birds view it. Imitate the ways other animals move about and imagine how they see, hear, smell, and taste their surroundings. How does their size affect the way they live? Of what importance are the colors of their bodies and the markings on them? What do humans have in common with these animals?

This kind of informal environmental exploration can greatly enhance group members' observational skills and their enjoyment of the ecosystems around them. Questions that cannot be answered with a simple yes or no encourage people to talk about their observations and better understand a place. The goal is to get group members—and yourself—to slow down and become good observers: a skill that can help us all better appreciate the wonder and complexity of our natural heritage.

Finally, remember to have fun. Exploring the environment is an adventure that leads to many discoveries. There always is more to learn. As a leader, you will be pleasantly surprised how satisfying it is to help other people become better observers and make their own environmental discoveries.



5. Leadership

TRAIL Boss requirement No. 4:

Learn about the following skills by reading the recommended resource materials and/or participating in a TRAIL Boss skills training course:

- ◆ **Environmental Awareness Skills** (These are covered in the chapter on Environmental Awareness.)
- ◆ **People Skills** (These are covered in the chapters on Leadership and Safety.)
- ◆ **Administrative Skills** (These are covered in the chapters on Group Assessment, Resource Management Agencies and Organizations, Partnerships, Project Selection, and Evaluation.)
- ◆ **Work Skills** (These are covered in chapters 9–14.)

WHAT ARE PEOPLE SKILLS?

TRAIL Bosses can greatly influence the quality of the experience for volunteers involved in conservation work. Leaders can enhance the environmental awareness opportunities of a project, encourage group members to learn and teach new skills, help them discover ways of cooperating with one another, and increase their satisfaction in doing something good for the world around them.

LEARNING LEADERSHIP

Effective leadership is a skill that is best learned by being a leader. Whenever you have the opportunity to lead, pay attention to how you are doing it and how people respond. Notice what methods are effective and which are not. Watch how other people lead and borrow from them the techniques that seem to work best.

Don't feel that you must know everything to lead well. Volunteers will respond positively if they see that you are willing to learn along with your group. In fact, some of your best teachers in the art of leadership may be the people you are leading.

MOTIVATING VOLUNTEERS

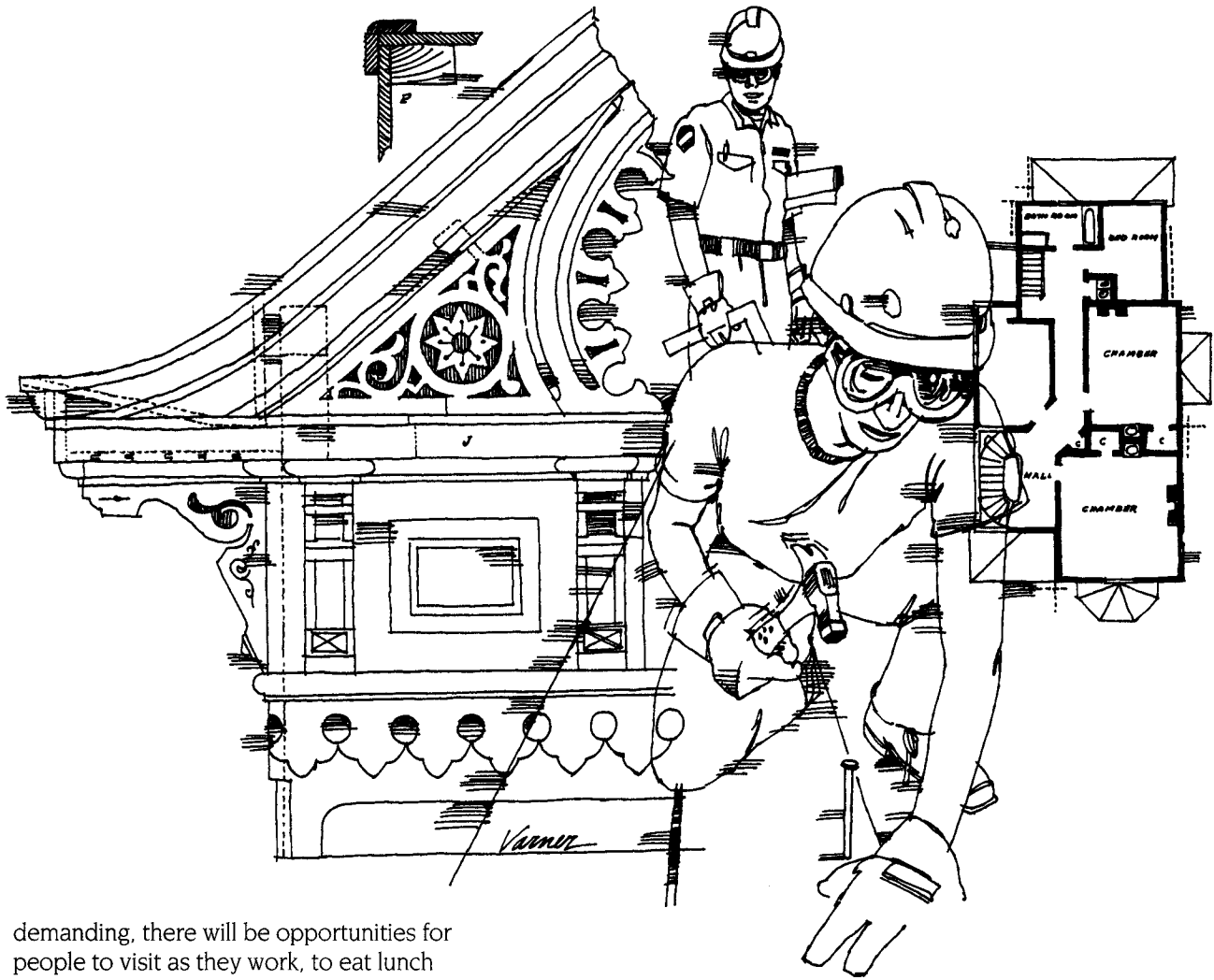
Volunteers involved in conservation work are giving their time and energy for reasons other than monetary gain. If you understand why they are inspired, you will be better able to design and supervise conservation activities that satisfy some or all of the concerns that motivate volunteers:

Fun

An obvious reason that people volunteer to do conservation work is to have a good time. A project holds forth the promise of being an adventure. It provides the chance for people to be in interesting places and to do activities new to their experience. A project might be combined with a picnic, a hike, a campout, swimming, canoeing, or other enjoyable activities.

Fellowship

Being with old friends and meeting new people are powerful motivators, especially when everyone is working toward the same goal. Although a project may be physically



demanding, there will be opportunities for people to visit as they work, to eat lunch together, and to savor the satisfaction of completing a group effort in the company of people they enjoy.

Service

Hands-on conservation projects can be very fulfilling for people who have a sincere desire to do something that will benefit the Earth. Leaders may find themselves running to stay ahead of groups that realize how much they can do to be of value to the environment.

Learning

Many people are attracted to volunteer conservation work as a way to learn. They want to master new skills, learn how to handle tools, develop a fresh understanding of nature, become familiar with agencies, explore career possibilities, or improve the environment. As they accumulate experience, they will be able to apply what they learn to future projects.

Recognition and Reward

Everyone likes to be recognized for doing good work. Volunteers' goals might include earning a patch or a certificate, passing a requirement for a badge, gaining work experience for a résumé, or preparing for a career in an environmental field.

BEING A GOOD LEADER

More than 2,000 years ago, the Chinese philosopher Lao-Tze wrote that they lead best who seem to lead least. Following that advice, effective leaders can provide the means for people to do good work and, at the same time, give volunteers the feeling that "we did it ourselves." Today we might describe that kind of leader as being a good facilitator who makes it possible for others to accomplish as much as they can and to realize the value of what they are achieving.

Whenever possible, involve volunteers in all aspects of planning and performing conservation work. Encourage group members to take part in decision making. For example, young people planting trees may not be able to determine where the trees should go, but they can decide which trees to plant first. By trusting them with the decisions, you are helping them feel greater project ownership.

Of course, there may be some decisions that leaders must make on their own, especially those affecting safety and project standards. Group members usually are willing to abide by practical rules if you share with them the reasoning behind the guidelines. Rather than losing your authority by explaining your decisions, you may find that your effectiveness as a leader is enhanced.

PITCH IN

Don't stay on the sidelines during a project. Do your share of the labor. You'll discover that people around you will be eager to join in and do their part, too.

Sometimes, however, you may need to back off on certain work. There often is value in allowing group members to grapple with a task as they gain new skills or overcome obstacles. Provide guidance and a helping hand as appropriate, but don't rob group members of a sense of achievement for doing the work themselves.

BE KIND TO YOURSELF

No matter how hard you try to plan and lead well, there will be times when nothing seems to go the way you had hoped. The weather at a work site may be miserable, your group's energy levels may be down, a project might not unfold as you had hoped it would, or interaction with resource managers may feel awkward.

While it is important to evaluate your performance at the end of an activity and to learn from both the positive and negative aspects of the experience, don't be too hard on yourself when activities do not go according to plan. Your perceptions of what happened may be different from those of group members and resource managers. The rains that dampened your enthusiasm might have been great, sloppy fun for your group. Though your group might not have completed as much work as you had intended, agency personnel may be completely

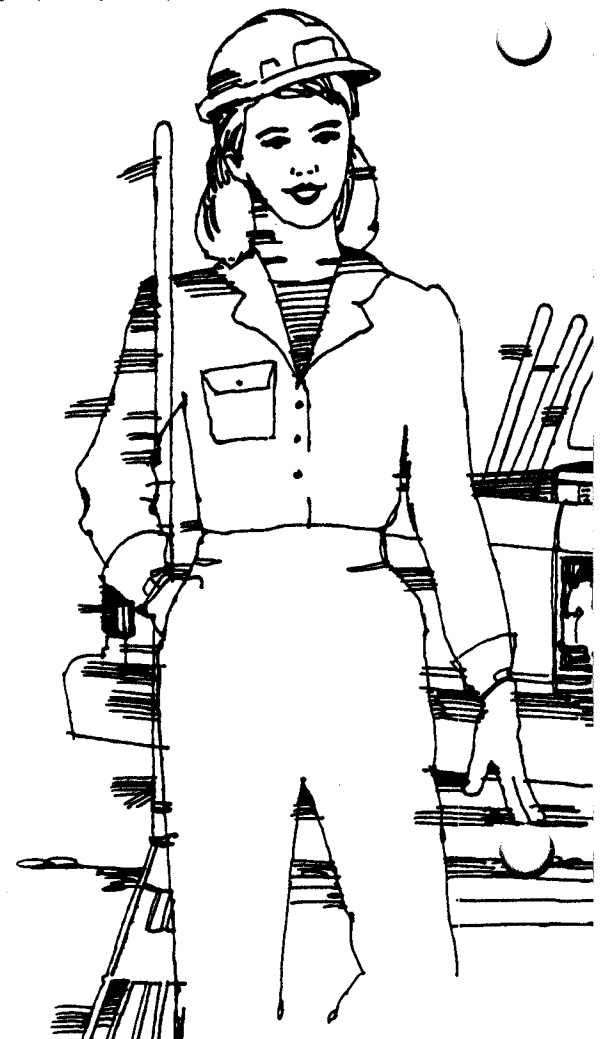
satisfied with your progress and be looking forward to your group's return.

As you consider the effectiveness of your leadership, try to gauge how volunteers feel about the entirety of an outing that included conservation work. Do they seem generally pleased with what they were able to do? Would they like to try something like it again? If the answer is yes, then the leadership you are providing is probably on track. If not, you might discuss with your group how you can make environmental opportunities more inviting.

Leadership is a learned skill. The more you do it, the more effective you will become. You will make mistakes—even the most experienced leaders do. But as long as you learn from your mistakes, no experience is wasted.

Don't be surprised if you learn as much from leadership decisions that don't go well as from those that do.

Finally, remember that important changes brought about by conservation work happen not only on the land, but also in the minds of volunteers. The ideas, attitudes, and enhanced environmental understanding initiated by hands-on work may outlast the results of a conservation project by many decades.



6. Safety

As a TRAIL Boss, you have much responsibility for the safety of your group. Through *teaching* and *showing by your own example*, you can ensure the safest possible work situation—one in which each person accepts the challenge of seeing that activities are safe for everyone.

TEACHING SAFETY

Most people are willing to follow safety guidelines if they understand the reasoning behind them. Whatever the safety concerns—wearing hard hats, maintaining sufficient distance between people swinging tools, staying out of swiftly moving streams, etc.—clearly explain the reasons for the guidelines, and you seldom will encounter much resistance to them.

Many group leaders conduct a “tailgate safety talk” at the beginning of each work day. The talk is an opportunity to review immediate safety issues. It also can be a time for group members to make suggestions for improving safety and to ask any questions they may have about why certain safety rules are in effect.

As volunteers become experienced with safe conservation work, TRAIL Bosses can invite them to conduct tailgate safety talks. One of the best ways to learn anything is to teach it.

SETTING A GOOD EXAMPLE

The strongest messages TRAIL Bosses convey are the examples they set. A group leader who preaches safety but practices questionable work methods should not be surprised to find others acting in ways that are less than prudent.



LIABILITY

Legal liability is a concern whenever volunteer groups consider working on public or private lands. If an accident occurs, who will be responsible for the costs of evacuation, medical treatment, and related expenses? To what degree can leaders be held accountable for what happens to members of their groups? What are the legal obligations of resource managers and landowners?

Many organizations carry accident insurance to cover injuries, and liability policies to protect leaders who act within reasonable guidelines. It is not unusual for a group to expect an injured individual's personal insurance to pay as much as possible, leaving the organization's policy to cover any outstanding costs. To qualify for an organization's insurance coverage, it may be necessary for a person to be a member in good standing.

Federal, state, and local land-management agencies usually insure volunteers involved in sanctioned activities, but requirements and limitations may apply. For example, some resource areas ask volunteers to fill out forms making them Volunteers in the Parks (VIPs) or Earth Team members to be fully covered by agency insurance.

LIABILITY WORK SHEET

- ◆ If volunteers are members of an organization, what insurance coverage does the organization carry?
- ◆ Must volunteers be members to be eligible for the organization's coverage? If so, how does one become a member in good standing?
- ◆ What coverage is offered by the resource management agency or organization that oversees the site of a potential project?
- ◆ Must volunteers register in some way or fulfill certain requirements to be eligible for agency coverage?
- ◆ If activities are to take place on private lands, what coverage will be provided by the owners and managers of those areas? By your organization?

For your own peace of mind and that of resource managers with whom you are working, take a few minutes to go over the Liability Work Sheet. If you or the conservation professionals are uneasy with the liability coverage or accident insurance protecting volunteers, you may want to work out alternative arrangements with group members, your organization, and resource managers. Should the subject of potential liability continue to be troubling, you may find it necessary to undertake conservation projects with a different agency or organization that can provide the assurances you need.

SAFETY IN THE FIELD

Work Site Pre-Project Visit

Visiting a potential work site before committing volunteers to a project will allow TRAIL Bosses and resource managers to identify safety hazards and to develop strategies for dealing with them. For example, you may discover the need for safety equipment such as goggles and gloves. Resource managers may decide it would be prudent to limit public use of campsites, historic buildings, trails, or other recreation areas while your group is completing construction or maintenance efforts. (For more on the pre-project visit, see the following chapter, Project Selection, on putting your TRAIL Boss skills to use.)

During the pre-project visit, TRAIL Bosses and resource managers can use the following checklist as a guide to develop a basic safety plan.

GROUP FIRST AID KIT

Don't mistake having equipment for being prepared. The knowledge to deal with emergencies is the most important thing you can carry. To help you put knowledge to use, have a well-stocked first aid kit at every work site.

Personal Clothing and Gear

The clothing and equipment that people bring to a project can increase comfort and safety. Long-sleeved shirts and long pants provide barriers against insects, dust, brush, and sunlight. Work gloves may be essential for the safe completion of some tasks. Anyone

Pre-Project Safety Checklist

- ◆ How can group leaders contact help if an accident occurs?
- ◆ Where is the closest hospital/clinic/emergency room?
- ◆ For projects in remote locations, resource managers should provide group leaders with a two-way radio. Will you be able to practice using it during the pre-project visit to become comfortable with its operation?
- ◆ List the telephone numbers of the following:

Resource management contact (office number and home number, because many volunteer projects take place on weekends when agency offices may be closed):

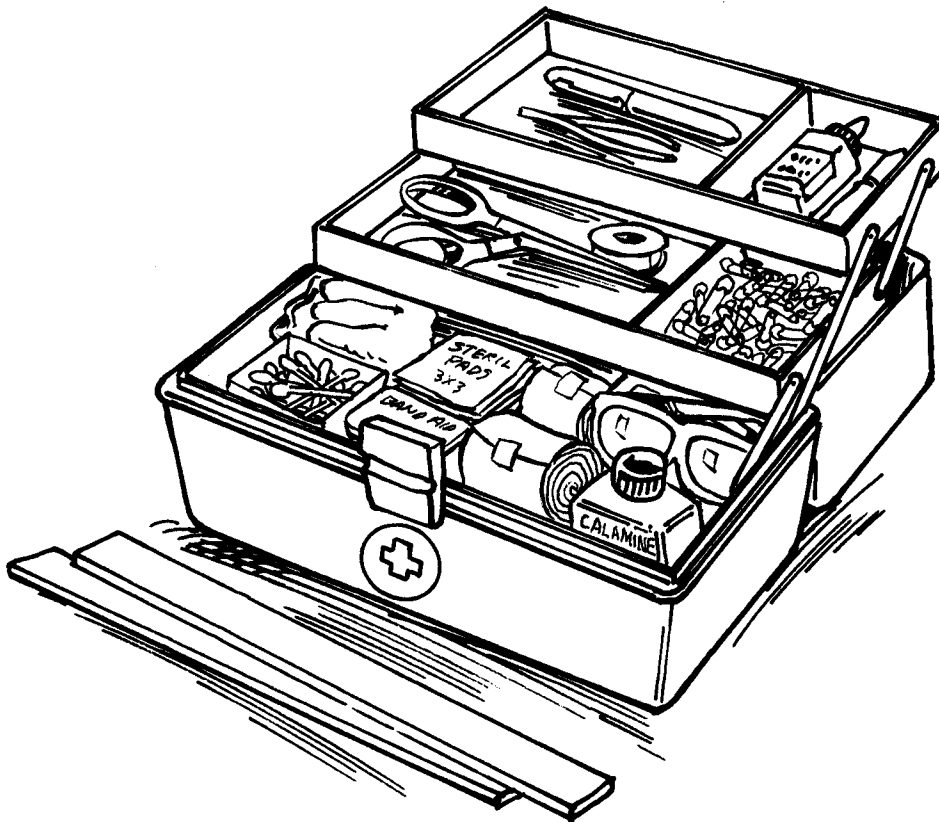
Office number _____

Home number _____

Local hospital: _____

Local sheriff: _____

- ◆ List the names of all volunteers who will be involved in the project. Include for each the phone number of a family member or other responsible person who should be notified in case of emergency.





swinging axes, Pulaskis, adzes, sledgehammers or similar tools should wear sturdy leather boots and long pants to protect their feet and legs.

WEATHER

Prepare group members for the worst extremes of weather they may experience in conservation work. At remote project sites in the backcountry far from the shelter of buildings, be especially aware of weather conditions that may change during the day.

Rain

Working in the rain can be enjoyable. However, group leaders must carefully consider whether rainy conditions are compromising safety. If the answer is yes, then close down the project until the weather improves.

Rain-related safety factors include:

- ◆ Raincoats, rain pants, and other bulky clothing may impede motion.
- ◆ Visibility may be restricted, especially for people wearing eyeglasses or safety goggles.
- ◆ Footing can turn precarious as the ground becomes slippery.
- ◆ Equipment may be more difficult to manage when hands, gloves, and tool handles are wet or muddy.

Cold

Hypothermia means "lack of heat." A victim of hypothermia has become so chilled that the body has difficulty producing enough heat to replace that being lost. Even in summer, wet weather presents the danger of hypothermia, especially if the wind is blowing. Mild hypothermia can make people uncomfortable and irritable. Severe cases are marked by a progression from shivering to disorientation, loss of muscle control, and, potentially death.

Should members of your group show signs of hypothermia, treat the condition *immediately*. Get them into a warm building, shelter, or tent. If possible, have them strip off wet clothing and put on dry clothes or crawl into dry sleeping bags. Provide hot drinks, soup, and other energy foods you may have.

Group leaders are not immune to hypothermia. Teach your group the symptoms of hypothermia and how to care for you if you show signs of becoming overly chilled.

Lightning

Stormy skies sometimes generate lightning. Any time you suspect conditions are favorable for lightning to occur, move your group away from exposed ridges, hilltops, open fields, or solitary trees. The electrical charge of a lightning bolt can be conducted by water seeping into caves, so avoid them as

Sample Checklist

- ___ **Shirts**
- ___ **Long pants or jeans**
- ___ **Boots or sturdy shoes**
- ___ **Gloves for protection and/or warmth**
- ___ **Bandanna or neckerchief**
- ___ **Rain gear**
- ___ **Sweater or jacket**
- ___ **Hat for shade or warmth**
- ___ **Water**
- ___ **Food**
- ___ **Sunscreen**
- ___ **Insect repellent**

well. If you are caught in a lightning storm, get away from tools, hard hats, cables, and any other metal objects that could attract a strike.

WEARINESS

People generally work best when they are rested and interested in what they are doing. As a day on a project progresses, pay attention to the apparent energy levels of group members. Take a break if they seem to be tiring. Have lunch or a snack. Encourage workers to put their feet up and rest for a few minutes.

Sometimes the weariness is mental rather than physical. When that seems to be the case, suggest that people switch jobs with one another so they can turn their attentions to something new. Or spend a few minutes looking at wildlife, identifying the vegetation near the work site, or enjoying some other activity that is not directly work-related, such as a swim.

Reviewing the work done and outlining the

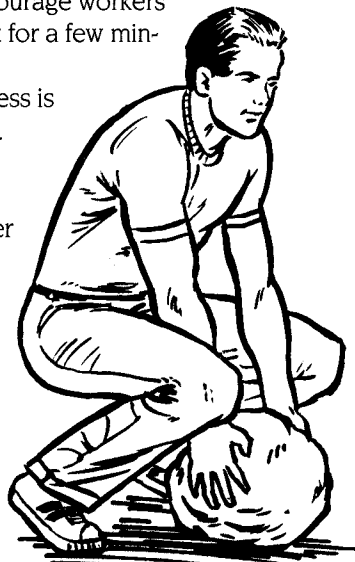
details of that left to accomplish may invigorate group members by reminding them of how much they have finished and what lies ahead. However, if weariness persists and low spirits threaten group safety or morale, store the tools and call it a day.

Lifting

Volunteers may be susceptible to strains and other injuries because of improper lifting techniques. TRAIL Bosses should teach group members correct lifting methods and then have them practice lifting light objects by keeping their backs straight and powering the lift with their legs.

When heavy objects must be moved, encourage a teamwork approach. Teach teammates to communicate clearly both in picking up heavy objects and putting them down. Also consider ways that lifting can be avoided. Rocks, logs, and other heavy materials often can be rolled in a controlled manner with far less effort and potential hazard than hoisting them off the ground.

LIFTING



7. Project Selection

TRAIL Boss requirement No. 5:

In cooperation with an agency or organization, select, plan, and carry out a project that is within the skill level of you and your group. Evaluate the results.

TRAIL Boss requirement No. 6:

Select, plan, and carry out two more conservation projects. These should provide further opportunities for increasing the work skills and environmental awareness of your group.

TRAIL Boss requirements 1–4 encouraged group leaders to

- ◆ Assess the interests and abilities of group members.
- ◆ Discover opportunities for conservation work and make contact with agencies managing public lands where these opportunities may exist.
- ◆ Explore issues of leadership, safety, liability, and environmental awareness.

The final TRAIL Boss requirements invite you to use your new knowledge to involve your group in actual conservation work. Ideally, resource managers or experienced TRAIL Bosses can be on hand to offer suggestions and validate your efforts.

CHOOSING A PROJECT

Other than the constraints of imagination and the requirements of resource managers, there are few limits to the kinds of conservation work volunteer groups can complete. The list of projects in the introduction of this manual suggests the variety and importance of what can be done.

A Group's First Project

The first conservation project a group attempts should further the process of developing a partnership with resource managers. To that end, select a project several weeks in advance so that everyone will have time to prepare.

Based on what they have learned about the volunteers and group leaders, resource managers can suggest one or more initial projects that fit the following guidelines:

- ◆ The work is matched to the skill level of volunteers.
- ◆ The project can be completed within a reasonable time, preferably a few hours to half a day.
- ◆ The task is of value to the environment, not busywork of little lasting importance that no one else wants to do.
- ◆ Group leaders will take a major role in supervising the work of volunteers.

Work Site Pre-Project Visit

Evaluating a work site a week or more before volunteers begin a project is an important step in planning conservation work. Accom-

Checklist for Evaluating Potential Projects

The following points will help resource managers match a project with a volunteer group:

- ♦ What do resource managers want to achieve with this project?
- ♦ How is the work valuable to your agency or organization? To the environment?
- ♦ What standards of quality and quantity of work do you expect of the group? How can you assess the success of its efforts?
- ♦ How long do you estimate it will take the group to do the project? Can the work be completed in the time the group has allotted? If not, can the project be broken into smaller parts that may be finished one at a time?
- ♦ What training should the group's leaders have to supervise volunteers doing the project? If the leaders need more background, how can they gain that experience for this and future projects?
- ♦ What tools and materials will be needed? Can the agency provide them? If not, where can they be obtained?
- ♦ Are you required to complete any studies, environmental impact statements, or other authorizations before the project may begin?
- ♦ In what ways will this project be challenging and satisfying for volunteers? Will it make them want to come back for more?
- ♦ Which resource manager can accompany group leaders to the site for a pre-project visit to help assess the practicality and safety of the work and resolve logistical details?
- ♦ Can any conservation professionals visit the site during the project to provide additional guidance, offer constructive advice to TRAIL Bosses, and thank the volunteers for their efforts?

panied by a resource manager, group leaders can assess the suitability of a project, identify safety hazards, determine what tools and materials will be required, and discuss the work standards the group will be expected to meet.

The following checklist can be used by group leaders and resource managers as a guide for gathering information during the pre-project visit:

BACKUP PROJECT

During the work site pre-project visit, it's a good idea for group leaders and resource managers to select a backup project that fits the same criteria as the work at the primary location. Should the initial project prove unacceptable, even at the last minute, or if the group finishes the first project more quickly than expected, the volunteers can turn their

attention to the backup project. If the backup work is not needed immediately, it can become the focus for a future conservation outing.

DURING A PROJECT

Stressing Safety

The chapter on Safety in this manual reminds leaders of the importance of setting safety standards for a group both by what they say and by what they do. Let volunteers know about the most important safety aspects of a project, then show them by your example that maintaining those standards is important for everyone, including the group's leaders and resource managers.

Pre-Project Visit Checklist

- ◆ Where is the project located?
- ◆ How will volunteers reach the site?
- ◆ How much time should volunteers allow for travel to the site?
- ◆ If volunteers arrive by automobile, van, or bus, where should they park their vehicles?
- ◆ What is the goal of the project? Is it a goal volunteers will be able to reach?
- ◆ Will group members be able to complete the project in the time they are at the site? If not, what portion of the work can they reasonably expect to finish?
- ◆ What are the steps of the project? In other words, what must the volunteers do to complete the work?
- ◆ What work skills will group leaders need to supervise this project? Do leaders have those skills? If not, is a resource manager willing to provide the information needed, or to help leaders oversee the work as a way of training them to be more effective in future projects?
- ◆ What tools and materials will volunteers need? Can the resource manager provide those items? Can the volunteers?
- ◆ Will volunteers need special clothing or personal gear? If they might get wet and muddy, should they bring a change of clothing for the trip home? Does anything about the area make you uneasy about a group's ability to work safely? Perhaps the proposed work is too close to traffic on a highway, too near a cliff, or in water that is deep or swift. If so, determine ways to minimize the hazard or move the project to another site before volunteers arrive.
- ◆ Is there drinking water near the site or should volunteers bring their own? Are rest-room facilities available?
- ◆ For backcountry projects reached on foot or by canoe, plan what to do in foul weather. Consider bringing cooking equipment for a hot midday meal and tarps to provide shelter from possible rain.
- ◆ Where is the closest telephone that could be used in an emergency?
- ◆ Where is the nearest medical facility? What is the quickest route to it?
- ◆ What opportunities for environmental awareness does the area present, either as a direct part of the project or as a related activity?

Pacing the Work

The speed at which a group works can be an issue of safety and of motivation. When volunteers are eager to do something well and they understand why their work is important, they usually will settle into a steady working pace.

If, on the other hand, you constantly are trying to hurry things along, step back for a few minutes and figure out what is going on. Ask questions and be a good observer. You may discover that people have grown tired and hungry, or that they are ready to trade tools and tasks with one another, or that it's time to

wrap up for the day and go home. However, you may find that a slower pace is more appropriate for the group on a particular project, and that you would do well to adjust your expectations.

Reflection

In the excitement of conservation work, volunteers sometimes lose sight of the significance of what they are doing. During lunch, a rest break, or on the walk home, try guiding the discussion toward their thoughts on the day's events. Invite group members to share

their feelings about what they did and their understanding of the ways their efforts will affect the environment. How did it feel to be using those tools, to be building, improving, and enhancing? How was this work similar to or different from other experiences they have had? What did they find most satisfying about the day?

A key to encouraging reflection is to ask questions that cannot be answered with yes or no. Of course, there are no wrong answers—each person has a unique understanding of an experience. The point of reflection is to provide people with a setting in which they feel comfortable sharing thoughts that might increase their understanding of an experience and illuminate its meaning and importance.

personal reward, but it's appropriate to also bestow something a little more tangible.

Many volunteer groups offer certificates, patches, and other forms of recognition for members who take part in environmental efforts. Resource management organizations and agencies may also have ways of honoring people who make significant contributions to conservation. An example is the Take Pride in America Award presented by federal resource management agencies to volunteers who have completed conservation work on public lands.

RECOGNITION

Everyone likes to be recognized for good works. The satisfaction of completing projects of value to the environment is a tremendous



8. Evaluation

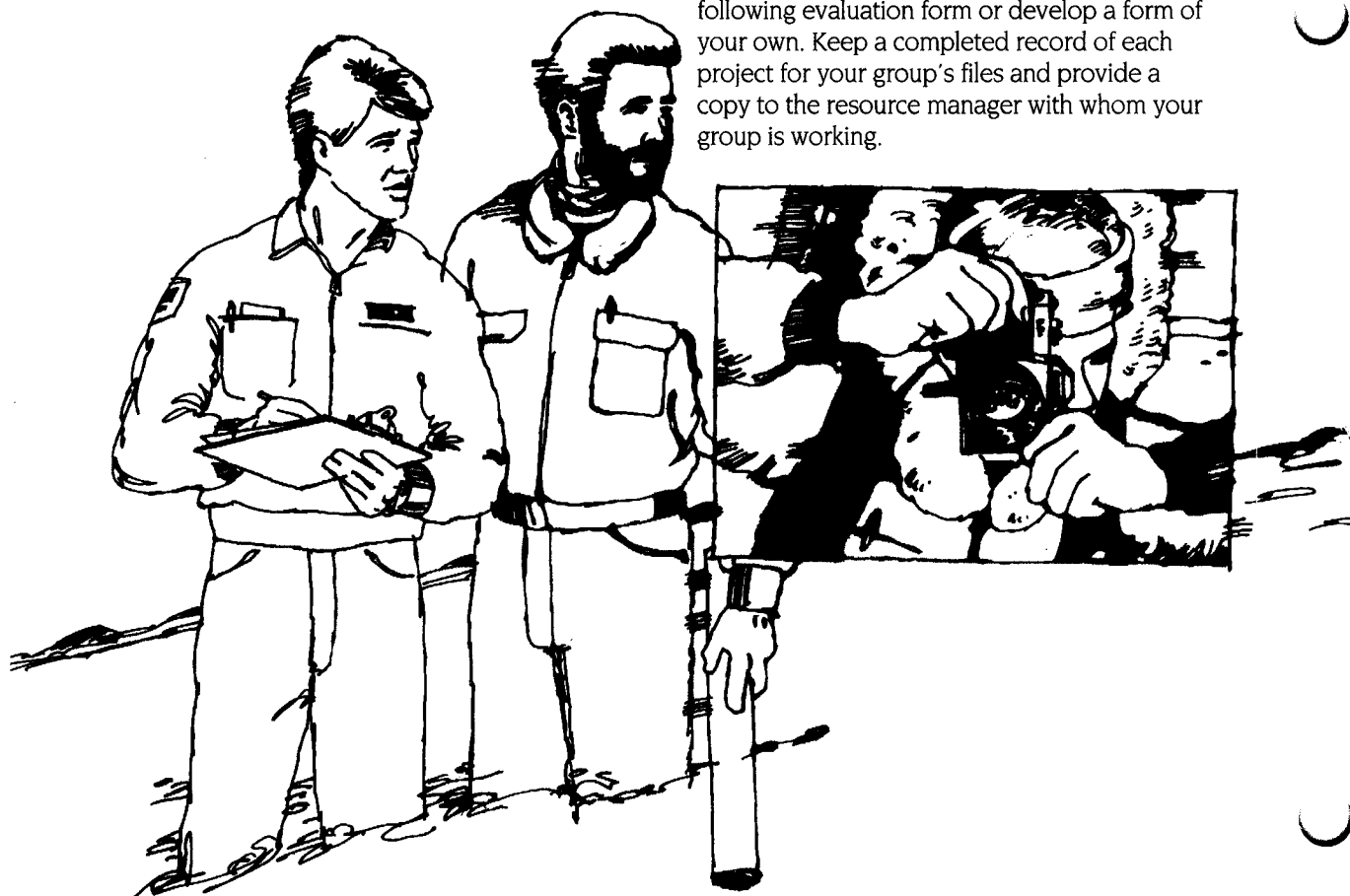
Evaluating the success of work projects is essential to building a strong relationship between a TRAIL Boss-led volunteer group and an agency or conservation organization. Resource managers who see that progress is being made will be enthused about involving volunteers in future work opportunities.

Evaluation also will help TRAIL Bosses strengthen their leadership skills. By carefully assessing the efforts of their groups, they can discover ways to improve the quality of the work and to increase the satisfaction that volunteers take from an experience.

At the least, an evaluation should contain the following information:

- ◆ How many volunteers were involved in the project? (Remember to include group leaders in your count.)
- ◆ How long did they work? (To figure person-hours, multiply the number of participants by the number of hours the group worked. For example, a group of 10 volunteers working for 8 hours has contributed 80 person-hours of effort.)
- ◆ What was accomplished? (Number of trees planted, length of shoreline repaired, percentage of monuments renovated, feet of trail cleared, etc. Give numbers, measurements, and amounts.)
- ◆ Add comments and recommendations that may help your group do a better job next time. Are there tools that will improve the efficiency of volunteers? Would additional skills help you lead your group more effectively? Is there further support the agency could provide?

You may wish to photocopy and use the following evaluation form or develop a form of your own. Keep a completed record of each project for your group's files and provide a copy to the resource manager with whom your group is working.



VISUAL RECORDS

Before-and-after photographs of projects provide clear evidence of the value of work done by volunteers. The pictures can illustrate dramatic changes—an historic structure before and after volunteers restore and paint it, for example, or a section of trail before and after a group clears the underbrush and repairs the tread. Photographs also can reveal the slower but equally striking changes occurring in revegetation areas and riparian zones that are being restored over a number of months and years.

Consider taking photographs of your group in action. Pictures of the fun and excitement of conservation work will serve as reminders of the good times and as encouragement to undertake future projects. The availability of home video cameras may make it feasible for groups to record important aspects of a project, then edit tapes into effective presentations.

Photographs also bring alive the words of evaluations. Whenever you can, include photos with the project evaluations you provide to resource managers.

RESOURCE MANAGER FEEDBACK

After resource managers have reviewed a TRAIL Boss group's evaluation and perhaps visited the work site, it can be constructive for them to discuss the effort with group leaders. The topics of greatest interest to resource managers may include the following:

- ◆ Does the project require more work?
- ◆ Was training sufficient for the demands of the project?
- ◆ Were agency involvement and support adequate?
- ◆ Are the volunteers interested in doing similar projects?

Group leaders may wish to discuss the following issues with resource managers:

- ◆ Which aspects of the project were appropriate for your group? Which were not?
- ◆ Did volunteers have all the tools and materials they needed to accomplish the work?



- ◆ Were agency expectations realistic? Were they clearly explained?
- ◆ How can future projects be even more successful?

GROUP EVALUATION

TRAIL Bosses often can learn a great deal by simply listening to what people say as they work, while they relax, and when they reflect on the experience. Leaders also may want to make an informal group evaluation a part of wrapping up each project. An end-of-project analysis can provide valuable information for improving future volunteer work experiences.

Such an evaluation may be based on the following questions:

- ◆ What did volunteers like about the experience?
- ◆ What did they dislike about it?
- ◆ In future projects, what would they do differently?
- ◆ Did they understand the reasons for the work they were doing?
- ◆ Did they feel that their efforts were important?

Listening to what conservation volunteers say is an important leadership skill. When you pay attention to the enthusiasm and the concerns of group members, you are letting them know that you value their ideas.

PROJECT EVALUATION

Volunteer Work Record

Date _____

Group _____

Leaders _____

Total number of volunteers and leader(s)

Total number of person-hours _____

Resource manager(s) involved _____

Location of work site _____

Description of work accomplished:

Task	Quantity	Person-hours

Comments and suggestions:

Introduction—Acquiring Skills

The skills described in the following chapters are a sampling of those used by TRAIL Boss leaders supervising groups of volunteers doing environmental work. Reading these pages will give you a sense of the tremendous possibilities of TRAIL Boss leadership and a basic understanding of some of the skills that may apply to conservation projects with your groups.

Of course, the real learning of environmental skills occurs in the field, especially when you have opportunities to work alongside experienced people. Two of the best ways TRAIL Bosses can master work skills are:

- ♦ Working alongside resource managers, maintenance crews, and other conservation professionals. For example, a TRAIL Boss interested in learning about eroded meadow restoration might volunteer several days to work with plant specialists doing meadow repair. Such a hands-on “apprenticeship” will allow the TRAIL Boss to master the basics of

a conservation skill. It also will help resource managers to determine the complexity of projects a TRAIL Boss is ready to supervise.

- ♦ Attending a TRAIL Boss training course designed to teach one or two specific skills. Usually conducted over a weekend, such courses may be hosted by agencies or conservation organizations. Experienced TRAIL Bosses and resource managers act as instructors. They teach by involving everyone in the completion of work in the field.

The mastering and teaching of work skills can be a lifelong adventure. The books listed in the bibliography more fully explain skills of special interest. Resource managers also may provide printed information that can be added to this manual.



9. Environmental Surveying and Monitoring

"This was my method of study. I drifted about from rock to rock, from stream to stream, from grove to grove. Where night found me there I camped. When I discovered a new plant I sat down beside it for a minute or a day, to make its acquaintance and hear what it had to tell. I asked boulders I met, whence they came and whither they were going."

—John Muir

Resource managers can wisely oversee public and private lands only if they know what those resources are and what is happening to them. For example, many agencies would be interested in measuring the amount

of vegetation in certain areas to determine its condition. Repeating those surveys each year could indicate the quantity and quality of vegetation and suggest reasons for any changes that may be occurring. That information would help managers determine whether the changes are within acceptable limits and, if not, to explore better ways to maintain the area.

Unfortunately, few conservation professionals have the time, as John Muir did, to drift about making the acquaintance of every rock, stream, and grove. Many volunteer groups, however, do have the hours and the desire to complete important monitoring efforts.



RESOURCE SURVEYS

Almost any survey information that volunteers accurately gather and properly record can be of value to resource managers, especially when initial surveys are followed with updates over months and years. Consider the following possibilities:

- ◆ Backcountry campsite locations, sizes, and conditions
- ◆ Vegetation types and amounts
- ◆ Inventories of damage to forests from insect infestations
- ◆ Depth of snowpack
- ◆ Quality of streams, lakes, and riparian zones
- ◆ Public use of lakeshores, beaches, picnic areas, and other recreation areas
- ◆ Extent of erosion on campsites, on hiking trails, in agricultural areas, and along streams
- ◆ Bird counts and nest locations
- ◆ Census of wild animals
- ◆ Locations of heavy concentrations of selected nonnative plants
- ◆ Soil surveys

TRANSECTS

A *transect* is a simple, effective way to gather information on plants, animals, and the impact of human activities. It is designed to be repeated at future intervals to ascertain whether long-term changes are occurring.

For example, resource managers may want to know if human impact on a lakeshore is harming vegetation. A volunteer group can use transects to measure the amount of ground that is bare. Where human impact is heavy, bare areas may indicate that the soil is too compacted to support plant growth. By repeating the survey at 6-month intervals, the group can determine whether the amount of bare ground is increasing or decreasing, and thus provide evidence of vegetation trends.

Conducting this kind of study can lead volunteers to a greater awareness of the complexity of the environment. As they monitor amounts of bare ground, they can see firsthand the connection between vegetation and erosion, between erosion and water quality,

between water quality and fish populations, and so on throughout an ecosystem.

Transect Tools and Techniques

Tools:

30-meter tape (A tape measure marked in meters permits simple computation of transect results.)

Compass

Pencil

Paper (Resource managers may prefer that graph paper or a certain sampling form be used.)

Techniques:

Begin the transect of an area by selecting a reference point near the edge of the site—a large rock, tree, or other object that should be there for years to come. Place the end of the tape measure at the base of the reference point, then stretch the tape across the site.

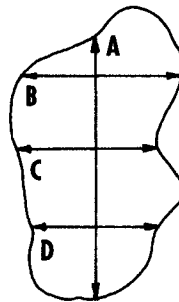
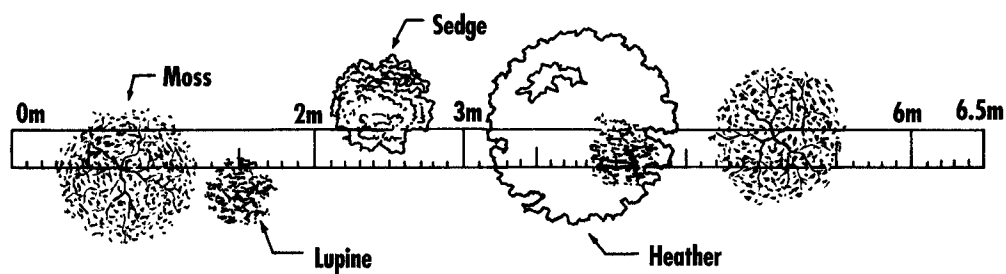
Use a compass to determine the orientation of the tape measure—15 degrees, for instance. Write down detailed location information about the reference point, where the tape touches it, and the compass bearing of the tape. The idea is to provide future surveyors with the guidance they need to place their tapes in exactly the same location as you have put yours.

Beginning at the 0 meter end of the tape, measure the extent of vegetation and bare ground under the tape. Note each measurement to the nearest centimeter and write it in your transect notes.

Sometimes the tape will pass over the widest part of a plant, or over only a leaf or two. Measure only the amount of vegetation touching your tape. Any variations should average into a representative sample of the area.

If parts of plants extend above the tape rather than lying beneath it, mentally extend vertical lines down from the edges of the plant to see where they would intercept the tape. Record that measurement just as you would if the plant were under the tape.

Once the information has been collected, you can determine the percentage of each species you have charted, or the amount of bare ground vs. soil covered by vegetation. Add up the number of meters/centimeters where “species X” occurs along the transect. Divide the sum by the length of the transect, then multiply that answer by 100. The resulting



Transect A = 6.5m
B = 5.2m
C = 5.0m
D = 4.7m

number is the percentage of the transect occupied by species X.

The information from a survey will be more valuable if you run several transects spaced about 3 meters apart across the site and then average the findings from all of the transects. These transects can be either parallel or perpendicular to the original transect. In each case, make careful notes of reference points and compass bearings so that future surveyors can place their tapes along the same transects you are using.

STREAM QUALITY SURVEYS

Federal and local government agencies currently monitor the water quality of only about 30 percent of the nation's rivers and streams. Volunteers can collect data that will help chart the conditions of many other waterways. Where the data indicate deteriorating water quality, volunteers can bring survey information to the attention of resource managers and become involved in the process of restoring a waterway to health.

The primary sources of water pollution are *point* and *nonpoint*. As its name implies, point source pollution enters a stream from a factory discharge pipe, a sewage treatment plant, or other specific point of origin.

Nonpoint source pollution is not so easily traced. Runoff from farmlands can contain pesticides, fertilizers, sediment, and manure. In urban areas, rain draining from lawns and golf courses can carry chemical and nutrient pollution into streams. Construction site sediment can smother spawning beds and clog the gills

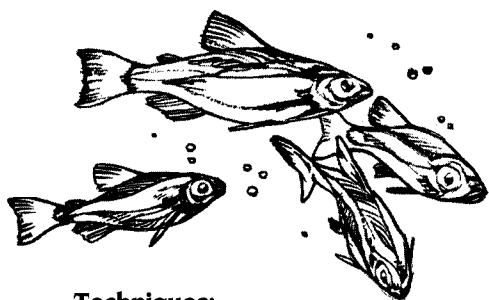
of fish. Storm drains may carry oil and anti-freeze into streams from streets and parking areas. Landfills sometimes leach toxins into waterways through overland flow and ground-water systems.

The Izaak Walton League's Save Our Streams (SOS) program is an effective model for involving people in monitoring and improving the condition of America's waterways. Volunteers use nets to collect organisms from the water, then count them and use the tallies as indicators of a stream's overall health. By repeating the process four times a year, volunteers can determine whether the condition of a stream is improving, staying the same, or worsening. Those findings will help groups and agencies decide how best to protect and enhance stream quality.

How to Conduct a Stream Quality Survey

Tools:

- ___ Kick-seine (for streams with rocky bottoms)
- ___ D-frame net (for streams with mud bottoms)
- ___ Tweezers
- ___ Plastic containers and jars for collecting specimens
- ___ Magnifying glass



Techniques:

Monitoring can be done at one spot in a stream or, for more representative findings, at quarter-mile intervals. For example, if you want to monitor a mile-long segment of a stream, select three or four monitoring locations. Write down an exact description of each monitoring station, including distinctive landmarks. Noting compass bearings may help you or other volunteers find the places to monitor in the future.

Don't monitor a site more than once each season (spring, summer, fall, winter). Excessively disturbing a location can damage the environment you are trying to survey.

When monitoring several stations, begin with the one farthest downstream so that organisms disturbed by your first test will not wash into your nets a second time.

Rocky Bottom Stream Sampling

1. Select a stream *riffle*—a shallow, fast-moving section with a depth of 3 to 12 inches and bottom stones 2 to 10 inches across or larger.
2. Place the kick-seine at the downstream edge of the riffle, fitting the bottom of the seine tightly against the streambed so that no organisms will slip under the net. (You may want to use rocks to hold down the edge of the seine.)

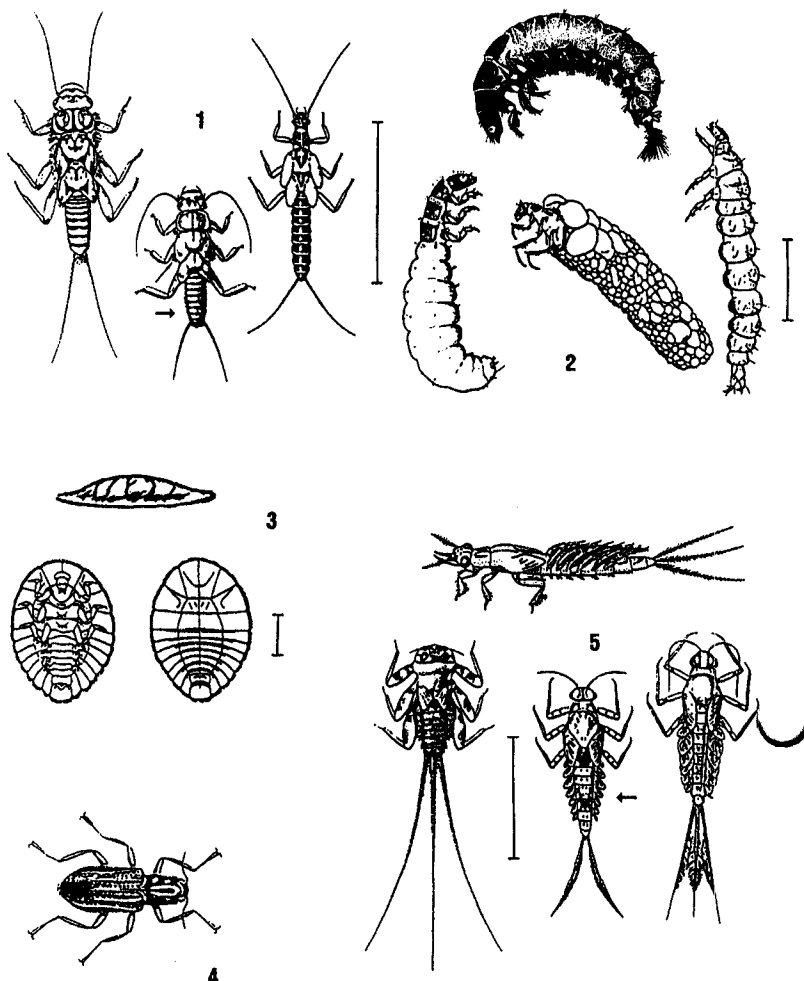


STREAM INSECTS AND CRUSTACEANS

GROUP ONE TAXA

Pollution-sensitive organisms found in good quality water.

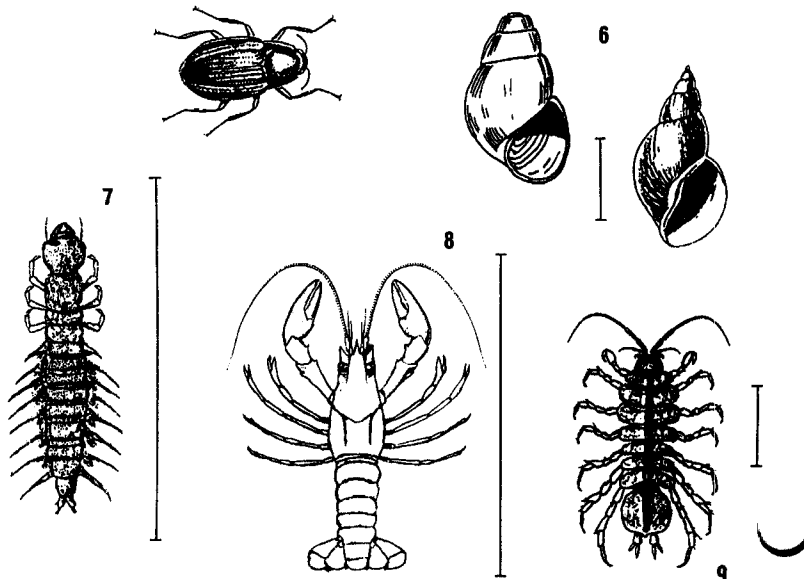
1. Stonefly: Order Plecoptera. $\frac{1}{2}$ "–1½", six legs with hooked tips, antennae, two hairlike tails. Smooth (no gills) on lower half of body. (See arrow.)
2. Caddisfly: Order Trichoptera. Up to 1", six hooked legs on upper third of body, two hooks at back end. May be in a stick, rock, or leaf case with its head sticking out. May have fluffy gill tufts on lower half.
3. Water Penny: Order Coleoptera. $\frac{1}{4}$ ", flat saucer-shaped body with a raised bump on one side and six tiny legs on the other side. Immature beetle.
4. Riffle Beetle: Order Coleoptera. $\frac{1}{4}$ ", oval body covered with tiny hairs, six legs, antennae. Walks slowly under water. Does not swim on surface.
5. Mayfly: Order Ephemeroptera. $\frac{1}{4}$ "–1", brown, moving, platelike or feathery gills on sides of lower body (see arrow), six large hooked legs, antennae, two or three long, hairlike tails. Tails may be webbed together.
6. Gilled Snail: Class Gastropoda. Shell opening covered by thin plate called operculum. Shell usually opens on right.
7. Dobsonfly (Hellgrammite): Family Corydalidae. $\frac{1}{4}$ "–4", dark-colored, six legs, large pinching jaws, eight pairs of feelers on lower half of body with paired cottonlike gill tufts along underside, short antennae, two tails and two pairs of hooks at back end.

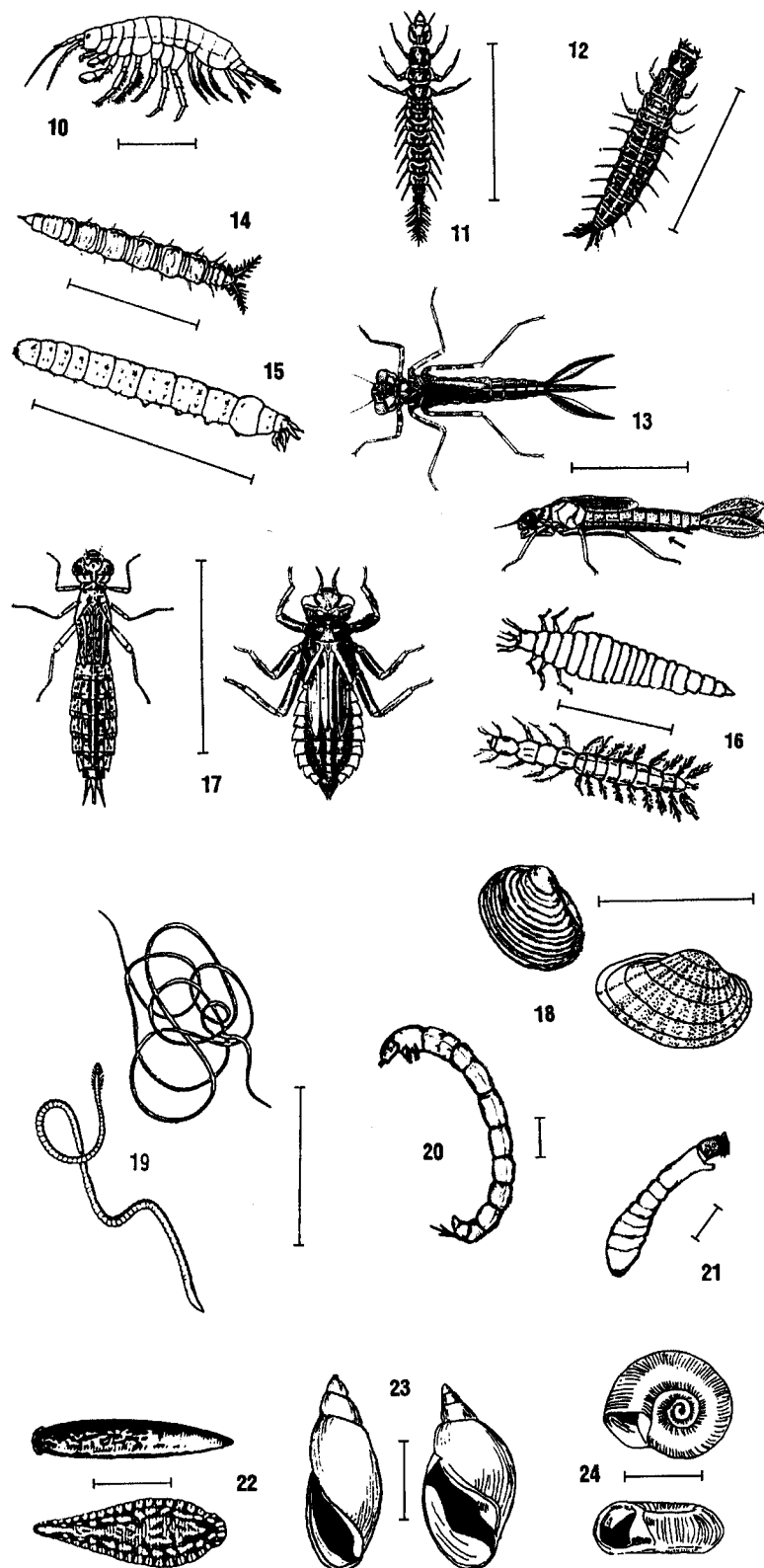


GROUP TWO TAXA

Somewhat pollution-tolerant organisms found in good or fair quality water.

8. Crayfish: Order Decapoda. Up to 6", two large claws, eight legs, resembles small lobster.
9. Sowbug: Order Isopoda. $\frac{1}{4}$ "–¾", gray oblong body wider than it is high, more than six legs, long antennae.
10. Scud: Order Amphipoda. $\frac{1}{4}$ ", white to gray, body higher than it is wide, swims sideways, more than six legs, resembles small shrimp.
11. Alderfly Larva: Family Sialidae. 1" long. Looks like small hellgrammite but has one long, thin, branched tail at back end (no hooks). No gill tufts underneath.
12. Fishfly Larva: Family Corydalidae. Up to 1½" long. Looks like small hellgrammite but often a lighter red-dish-tan color, or with yellowish streaks. No gill tufts underneath.





13. Damselfly: Suborder Zygoptera. $\frac{1}{2}$ "–1", large eyes, six thin hooked legs, three broad oar-shaped tails, positioned like a tripod. Smooth (no gills) on sides of lower half of body. (See arrow.)
14. Watersnipe Fly Larva: Family Athericidae (Atherix). $\frac{1}{4}$ "–1", pale to green, tapered body, many caterpillarlike legs, conical head, feathery "horns" at back end.
15. Crane Fly: Suborder Nematocera. $\frac{1}{2}$ "–2", milky, green, or light brown, plump caterpillarlike segmented body, four fingerlike lobes at back end.
16. Beetle Larva: Order Coleoptera. $\frac{1}{4}$ "–1", light-colored, six legs on upper half of body, feelers, antennae.
17. Dragonfly: Suborder Anisoptera. $\frac{1}{2}$ "–2", large eyes, six hooked legs. Wide oval to round abdomen.
18. Clam: Class Bivalvia.

GROUP THREE TAXA

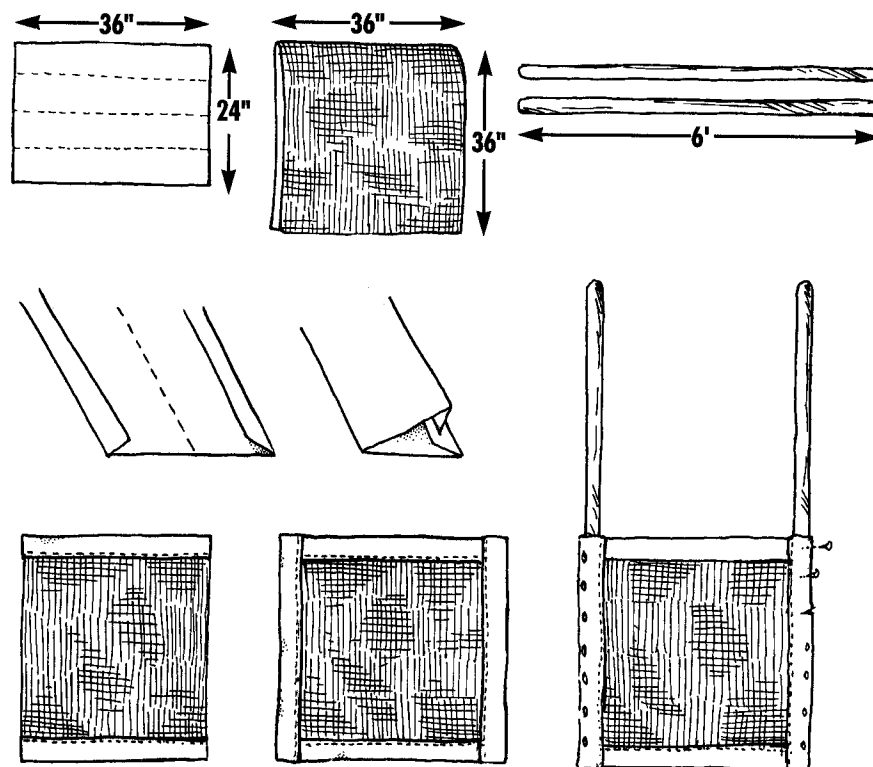
Pollution-tolerant organisms found in any quality of water.

19. Aquatic Worm: Class Oligochaeta. $\frac{1}{4}$ "–2", can be very tiny; thin, wormlike body.
20. Midge Fly Larva: Suborder Nematocera. Up to $\frac{1}{4}$ ", dark head, wormlike segmented body, two tiny legs on each side.
21. Blackfly Larva: Family Simuliidae. Up to $\frac{1}{4}$ ", one end of body wider. Black head, suction pad on end.
22. Leech: Order Hirudinea. $\frac{1}{4}$ "–2", brown, slimy body, ends with suction pads.
23. Pouch Snail and Pond Snails: Class Gastropoda. No operculum. Breathe air. Shell usually opens on left.
24. Other Snails: Class Gastropoda. No operculum.

Save Our Streams
Izaak Walton League of America
1401 Wilson Boulevard, Level B
Arlington, VA 22209

Bar lines indicate relative size.

Illustration courtesy of Izaak Walton league



KICK-SEINE NET

3. Disturb the stream bed for a distance of 3 feet upstream of the kick-seine. Brush your hands over all rock surfaces to dislodge attached insects. Stir up the bed with your hands and feet until the entire 3-foot-square area has been disrupted and the current has carried any insects into the net. Finally, shuffle your feet with a sideways motion toward the net to bring up organisms from under the streambed.
4. Lift the net from the water without allowing any insects to be washed from its surface.

Muddy Bottom Stream Sampling

Use a dip net rather than a kick-seine to gather organisms from streams with muddy bottoms or slow currents. Dip the net in the water and scrape the stream bottom so that organisms go into the net. Scrape the mouth of the net along submerged tree roots, logs, and leaf packs and scoop a good sampling of organic debris into the net.

Recording Your Sample

Spread the kick-seine or dip net on the shore on a dry, flat, light-colored surface. Using tweezers, gently remove all the creatures from the net and place them in your containers. Collect everything that moves, no matter how small. Many insects will be the same color as wet leaves and other debris, so look closely.

Separate the organisms into look-alike groups, using the SOS Stream Insects and Crustaceans Card for guidance. Clues to their identity include the number of tails and legs, length of antennae, whether they have claws, and how they move.

Total the number in each group, record your findings on the SOS Stream Quality Survey, and tabulate your results to determine water quality. The SOS survey will guide you in dividing insects into three groups:

- ◆ Indicators of good water quality. Mayflies, caddis flies, and stone flies must have abundant levels of oxygen. They will not survive in water with much pollution.

- ◆ Indicators of fair water quality. Crayfish, crane flies, sowbugs, and others in this group can tolerate some pollution.
- ◆ Indicators of poor water quality. Leeches and worms, midge fly larvae, and other organisms that can endure with quite heavy pollution comprise this group.

Studying the Find.

Filling out the SOS Stream Quality Survey form will give a stream sample a rating of *excellent*, *good*, *fair*, or *poor*. Increase the accuracy of your results by taking two additional samples from riffles in the same general area as the first. New locations should always be upstream of any others you have monitored that day to ensure that the organisms you catch are not those dislodged from previous test sites. Of the three sites, record the one that gives the highest quality rating for the stream. Resource managers will help your group give meaning to the numbers.

You can register your findings nationally with the Izaak Walton League's Save Our Streams Program by sending copies of your forms to:

The SOS Program
Izaak Walton League of America
1401 Wilson Boulevard, Level B
Arlington, VA 22209

The League can give you further guidance in conducting stream monitoring, carrying out waterway improvement projects, and referring

you to water quality experts in your area.

The Soil Conservation Service is another valuable resource for the monitoring and protection of streams. The Service's *Water Quality Indicators Guide*, available with a teacher's guide, provides a detailed overview of stream monitoring methods and identification of plants and animals that can be used as indicators of water quality.

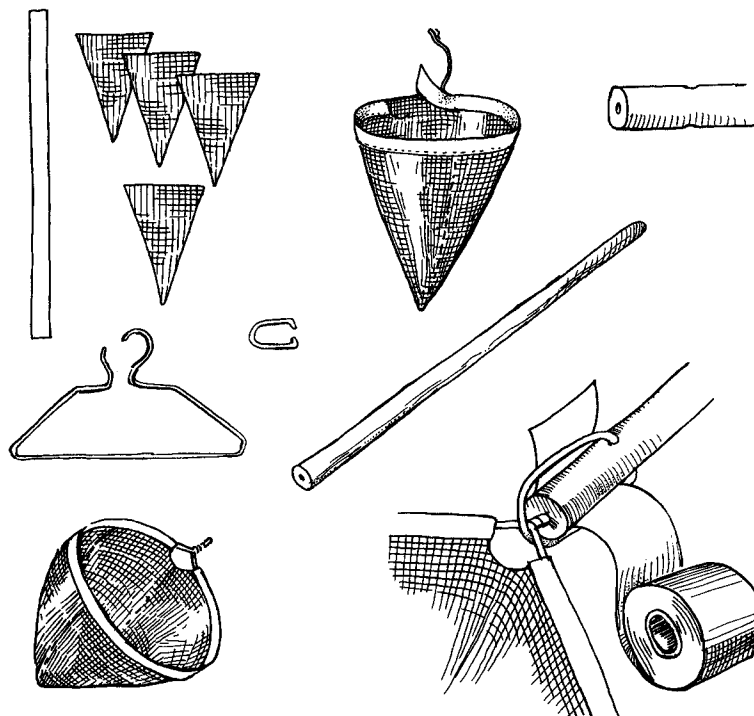
Constructing a Kick-Seine Net

Materials needed:

- ___ 3-foot by 6-foot nylon screening ($\frac{1}{16}$ -inch mesh)
- ___ four strips of heavy canvas (6 inches \times 36 inches)
- ___ two broom handles or wooden dowels, each 6 feet long
- ___ thread, sewing machine, finishing nails, hammer, iron

1. Fold over $\frac{1}{2}$ inch of the edges of the canvas strips and sharply crease the folds by pressing them with a hot iron. That will prevent unraveling after they have been sewn on the screen as reinforcing borders.
2. Fold the nylon screen in half (3 feet \times 3 feet).
3. Sew a strip of canvas across the bottom of the doubled screen and another strip across the top.

D-FRAME NET



4. Sew the remaining canvas strips down the sides of the net so that each forms a sheath large enough to accommodate a broom handle or dowel.
5. Insert the broom handles or dowels in the side sheaths and nail them in place with finishing nails.

Constructing a D-frame Net

Materials needed:

- ___ four triangles of nylon netting ($\frac{1}{2}$ -th-inch mesh), each piece 10 inches \times 12 inches
- ___ bias tape or scrap fabric, 40 inches \times 1 inch
- ___ wire coat hanger
- ___ broom handle or wooden dowel (4 feet long)
- ___ drill with $\frac{1}{4}$ -inch wood bit
- ___ pliers and duct tape
- ___ thread, scissors, sewing machine

1. Sew the four triangles of netting together to form a cone-shaped net.
2. Cut a 40-inch strip of bias tape or fabric to make a casing. Sew it onto the net opening. Leave the casing open for the insertion of a wire frame.
3. Untwist the wire coat hanger, slip it into the net casing to form the net's frame, and re-twist the wire.
4. Cut off the hook of the hanger. Drill a hole in the end of the broom handle and insert the remaining neck of the hanger.
5. Bend the hanger hook into the shape shown in the illustration. Position it to hold the D-frame net against the broom handle and push the bent ends of the hook into holes drilled in the handle. Wrap with duct tape.

WILDLIFE SURVEYS

Visual counts of animal populations can be exciting and educational for TRAIL Boss volunteers and of great value to resource managers. The specific skills TRAIL Bosses need to

supervise their groups conducting a wildlife survey will depend upon the species being studied and the habitat in which it lives.

Bird counts, for example, may be done from blinds or observation decks, or during walks through selected areas.

Volunteers will need binoculars, identification books, and notebooks or bird census forms.

Other surveys may draw upon information gathered from the frequency and kinds of animal droppings, of types and quantities of insects captured in nets, or any of dozens of other methods. A good example of a worthwhile wildlife survey is an inventory of den trees.

Den Tree Survey

Many birds and mammals make their nests in the cavities of trees. A few species such as woodpeckers can create their own holes, but most species must find cavities that are the result of insect activity, branches torn away by wind or snow or other natural processes.

Trees with dens are so vital to certain species that wildlife managers often take steps to protect and nurture the development of existing or potential den trees. They can do that only if they know where those trees are located and the condition of each.

Volunteers under TRAIL Boss leadership may be able to provide an important service to wildlife by documenting the location of den trees in a selected area. The primary tools for such a survey are good observation skills and much patience. Binoculars, detailed topographical map, notebook, and compass will improve chances of success.

With the help of a resource manager, draw a line on the map to indicate the border of the area to be studied. Study the topography of the area and devise a scheme to survey all of it. Perhaps you can plot a hiking route that follows features of the terrain to bring you within visual range of most parts of the area. If the terrain is not conducive to that or if heavy vegetation limits visibility, consider following compass bearings through the area, spaced to maximize volunteers' likelihood of finding den trees.

Once in the field, group members make a careful search for trees with cavities. Pay special attention to dead standing trees and watch for the activities of birds and other animals that may reveal the locations of dens. Seed husks or shells, scat, and other signs at the base of a tree may be clues that there is a den above.

Accurately mark on a map the location of each den tree and give it a number. Record the number in a notebook and write a description of the tree and the den. Be specific, noting the size of the cavity opening and its height above the ground, its current use by animals, the diameter and height of the tree, its overall condition, and the composition of surrounding wildlife habitat.

Resource managers also may suggest that you mark each tree, perhaps by attaching a metal tag to it or using permanent paint to mark it discreetly with its survey number. In the future, volunteers repeating the survey can use that marking to help monitor changes in the condition of each tree and its den.



SAVE OUR STREAMS

Stream Quality Survey

The purpose of this form is to aid you in gathering and recording important data about the health of your stream. By keeping accurate and consistent records of your observations and data from your macroinvertebrate count, you can notice and document changes in water quality. Refer to the SOS insect card and instructions to learn how to trap and identify the organisms.

Stream _____ Station _____
 County _____ State _____ Location _____
 Group or individual _____ Number of participants _____
 Weather conditions _____
 Stream width (Average) _____ ft. Stream depth (In riffle) _____ ft.
 Flow rate: high _____ low _____ normal _____

You should select a riffle where the water is not running too fast (ideal depth is 3–12 inches), and the bed consists of cobble-sized stones or larger.

Monitored riffle area (should be 3 foot square) _____ Water depth (inches) _____ Water temperature _____
 Date _____ Time _____ Sample Number _____
 Type of test: _____ macroinvertebrate count _____ chemical test _____ other _____

MACROINVERTEBRATE COUNT

Use the stream monitoring instructions to conduct a macroinvertebrate count. Use letter codes (A = 1–9, B = 10–99, C = 100 or more) to record the numbers of organisms found in a 3 foot by 3 foot area. Then add up the number of letters in each column and multiply by the indicated index value. The following columns are divided based on the organism's sensitivity to pollution.

SENSITIVE	SOMEWHAT-SENSITIVE	TOLERANT
<input type="text"/> caddisfly larvae <input type="text"/> hellgrammite <input type="text"/> mayfly nymphs <input type="text"/> gilled snails <input type="text"/> riffle beetle adult <input type="text"/> stonefly nymphs <input type="text"/> water penny larvae	<input type="text"/> beetle larvae <input type="text"/> clams <input type="text"/> crane fly larvae <input type="text"/> crayfish <input type="text"/> damselfly nymphs <input type="text"/> dragonfly nymphs <input type="text"/> scuds <input type="text"/> sowbugs <input type="text"/> fishfly larvae <input type="text"/> alderfly larvae <input type="text"/> atherix	<input type="text"/> aquatic worms <input type="text"/> blackfly larvae <input type="text"/> leeches <input type="text"/> midge larvae <input type="text"/> pouch (and other) snails
<input type="text"/> # of letters times 3 = _____ index value +	<input type="text"/> # of letters times 2 = _____ index value +	<input type="text"/> # of letters times 1 = _____ index value

Now add together the three index values = _____ total index value.

Compare this total index value to the following numbers to determine the water quality of your stream. Good water quality is indicated by a variety of different kinds of organisms, with no one kind making up the majority of the sample.

WATER QUALITY RATING

☐ Excellent (>22) ☐ Good (17–22)
☐ Fair (11–16) ☐ Poor (<11)

Note: You should test at least 3 different riffles within a 24-foot area to ensure that you have a truly representative sample which includes all key organisms. Record results from the sample which gives the best diversity.

Fish water quality indicators:

- ☐ scattered individuals
☐ scattered schools
☐ trout (intolerant to pollution)
☐ bass (somewhat-tolerant to pollution)
☐ catfish (tolerant to pollution)
☐ carp (tolerant to pollution)

Barriers to fish movement:

- ☐ beaver dams
☐ dams
☐ waterfalls
☐ other
☐ none

Surface water appearance:

- ☐ brownish
☐ clear
☐ colored sheen (oily)
☐ foamy
☐ milky
☐ muddy
☐ brown
☐ black
☐ grey
☐ other ()

Odor:

- ☐ rotten egg
☐ musky
☐ oil
☐ sewage
☐ none

Stability of stream bed:

Bed sinks beneath your feet in:

- ☐ no spots
☐ a few spots
☐ many spots

Stream bed deposit (bottom)

- ☐ grey
☐ orange/red
☐ yellow
☐ black
☐ brown
☐ silt
☐ sand
☐ other ()

% bank covered by plants, rocks, and logs (no exposed soil) is:

Stream bank (sides)
Top of bank (slope and floodplain)

Good
>70%

Fair
30%–70%

Poor
<30%

(> = greater than, < = less than)

Stream bank vegetation composition:**Stream bank erosion:**

- ☐ % shrubs
☐ >80% severe
☐ 20%–49% moderate,

☐ % grasses

☐ % trees

- ☐ 50%–80% high,
☐ <20%–0% slight

Bed composition of riffle:

- ☐ % silt (mud)
☐ % sand (1/8"–1/4" grains)
☐ % gravel (1/4"–2" stones)
☐ % cobbles (2"–10" stones)
☐ % boulders (> 10" stones)

Algae color:

- ☐ light green
☐ dark green
☐ brown coated
☐ matted on stream bed
☐ hairy

Algae located:

- ☐ everywhere
☐ in spots
☐ % bed cover

Land uses in watershed: Record all land uses observed in the watershed area upstream and surrounding your sampling site. Indicate whether the following potential land uses have a high (H), moderate (M), or slight (S) potential for impact. Refer to the SOS stream survey instructions to determine how to assess H, M, or S values.

- ☐ Oil & gas drilling
☐ Housing developments
☐ Forest
☐ Logging
☐ Urban uses (parking lots)
☐ Sanitary landfill
☐ Construction
☐ Mining (types)
☐ Cropland (types)
☐ Refuse dump
☐ Fields
☐ Livestock pasture
☐ Other ()

Are there any discharging pipes? ☐ no ☐ yes If so, how many? _____

What types of pipes are there? ☐ runoff (field or stormwater runoff) _____
☐ sewage treatment, ☐ industrial: type of industry _____

Did you test above and below the pipes to determine any change in water quality and were changes noticed? _____

Describe % and type of litter in and around the stream: _____

Comments Indicate what you think are the current or potential future threats to your stream's health: _____

10. Revegetation and Restoration

Vegetation is critical to the health of the environment. Plants provide shelter and food for wildlife of all sizes and habits. With leaves and branches that break the force of rainfall, and with root systems that hold the soil in place, vegetation helps prevent the ravages of erosion. The rich diversity of plant species suggests an environmental complexity we are only beginning to understand.

Lakeshores, streambanks, trails, abandoned roads, campsites, meadows, alpine tundra—many portions of public and private lands subject to human use show signs of vegetation loss and the subsequent erosion of soil. Sometimes the harm is caused by loving the land to

death—too many people walking, playing, and camping in the same areas, or riding horses, bicycles, or motorized vehicles over plant communities. Damage also can be caused by working the land too hard or using unwise practices of livestock grazing, logging, and mining.

Nurturing damaged vegetation back to health requires a commitment of time and energy that can make this kind of work inviting to volunteers led by TRAIL Bosses. Progress may be slow, but as group members return many times to address the needs of a project site, they will see dramatic long-term improvement.



REVEGETATION AND RESTORATION— WHAT THEY MEAN

Agency personnel who specialize in repairing damaged lands sometimes differentiate between *restoration* and *revegetation*. It may be helpful for TRAIL Bosses to understand what those terms mean.

Revegetation is the art of reintroducing plant communities to an area where, for some reason, vegetation has been discouraged from growing. Transplanting trees and sowing grass seed on top of mine tailings is an example of revegetation.

Restoration is the process of restoring an area to the condition it was in before its natural integrity was disrupted. Restoration of mine tailings would include contouring the terrain, bringing in topsoil and seed, and doing whatever else was necessary to make the area look as it would have had there never been a mining operation.

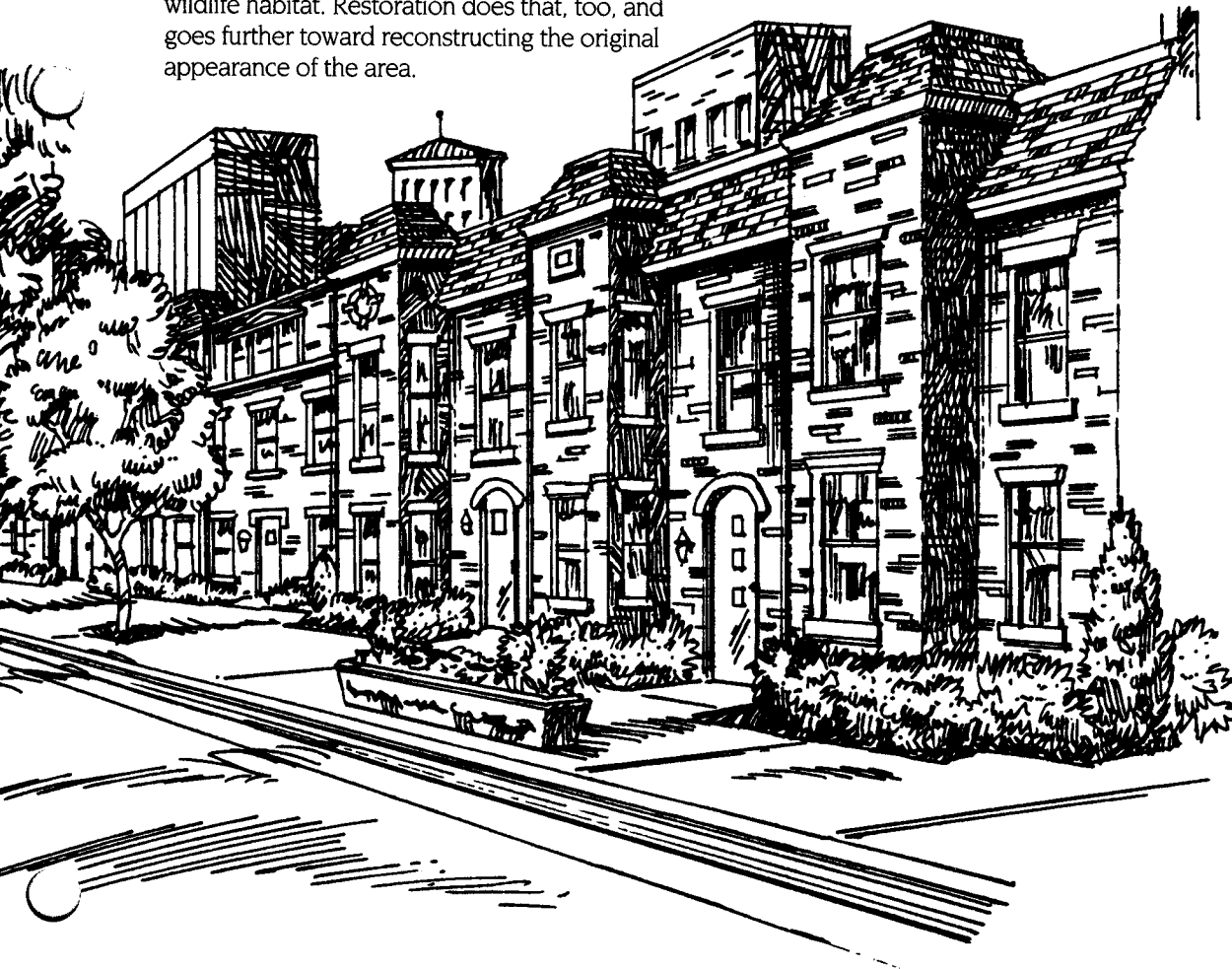
Revegetation can improve the appearance of an area, protect it from erosion, and enhance wildlife habitat. Restoration does that, too, and goes further toward reconstructing the original appearance of the area.

Agencies have been restoring historic buildings for a long time. Upgrading significant structures may not seem unusual to us, but the idea of restoring old campsites, abandoned mining and logging operations, and overgrazed meadows is a fairly new and exciting concept.

Of course, it is not always possible to restore a site to the condition it was in before human activity disturbed it. A centuries-old climax forest that has been cleared cannot be recreated within the lifetimes of volunteers, no matter how hard they try. However, they can reestablish the early stages of such an ecosystem so that it can more efficiently move on its own toward becoming a mature forest once again.

SETTING GOALS

Many valuable projects involving vegetation are simple. Planting trees for windbreaks, stabilizing streambanks with proper vegetation, transplanting grasses and shrubs into barren ground,



removing exotic species so that native plants can thrive—these efforts all can be extremely important in enhancing the environment.

In contrast, some of the most complex restoration initiatives involve designated wilderness areas. Through legislation, protection, and ongoing repair work, agencies attempt to preserve the appearance of selected lands as they would have looked during the era of the American frontier. The pioneer spirit of that time is often embedded in the details of the wilderness concept—for example, riding horses is allowed, but not riding bicycles. Crosscut saws and other hand tools may be used for trail repair, but chainsaws may not.

The importance of these differences is simply this—for revegetation and restoration work, TRAIL Bosses and agency staff must have a clear goal in mind before a project begins. The goal may be to improve the appearance of a place, or to ensure basic erosion control, or to do everything necessary to return the area to a pristine condition. A group with a well-considered goal can work toward it with productive intent.

KINDS OF PROJECTS

The most visible damage that occurs when an area is overused by humans or livestock is the breaking, crushing, or close cropping of vegetation. Plant cover becomes thin and beaten down, or disappears altogether.

The damage you do not see may be of even greater concern. Heavy use often packs the earth, collapsing small air pockets and hardening the soil. Tiny root ends may no longer be able to push through. Mycelia, bacteria, and other microscopic organisms essential to the vitality of vegetation may be unable to survive. Compacted soil cannot absorb water quickly, leading to more runoff, erosion, and declining water quality.

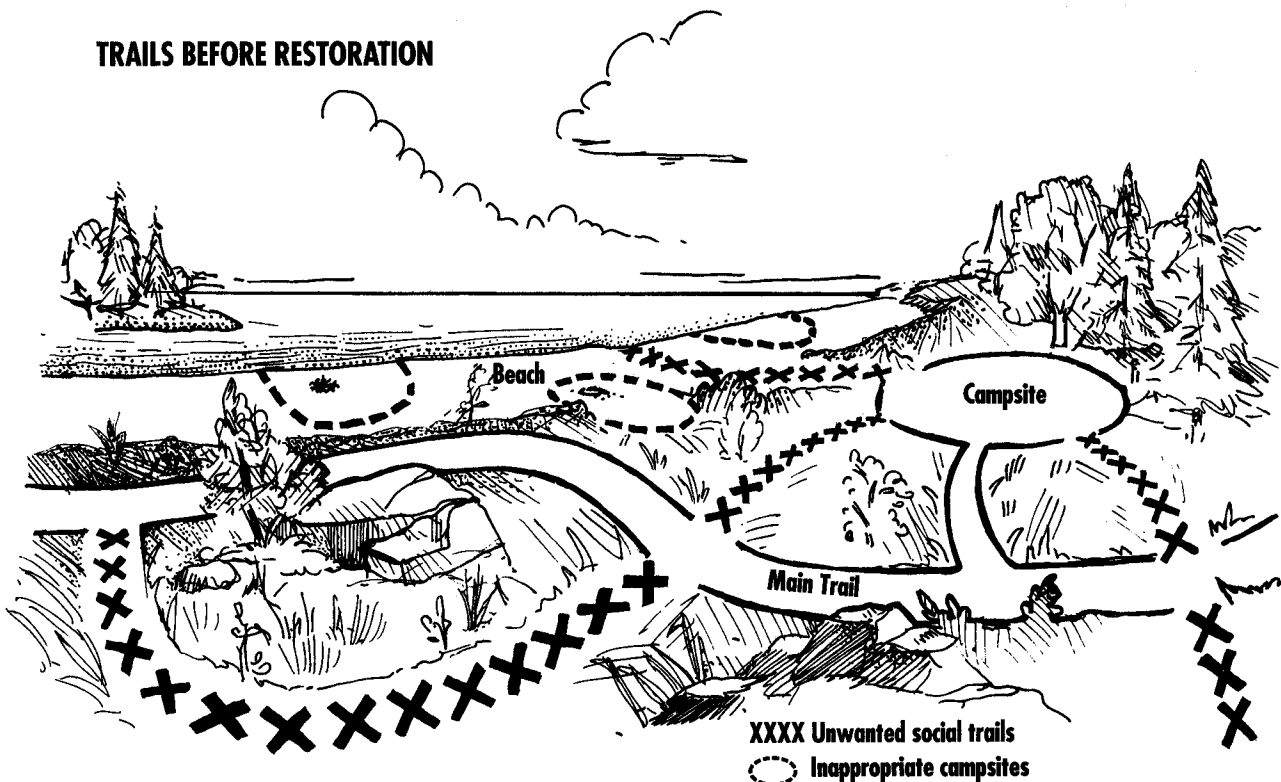
Most areas damaged by the impact of humans or livestock can be revegetated or restored. Two that respond especially well to volunteer efforts are social trails and inappropriate campsites.

Social Trails

A trail 2 feet wide represents nearly a quarter acre of bare ground per mile. Because the tread is so compacted, little will grow upon it, which helps make a planned trail an inviting place for people and animals to walk. By concentrating use on the trail rather than upon the surrounding environment, impact can be limited to the already-hardened tread. An intentional trail is a sacrifice zone that we accept because it encourages people to restrict the negative effects of their travel to the pathway.

Problems arise when users stray from a trail and, by trampling vegetation and compacting soil elsewhere, create *social trails*. These unplanned trails often radiate from campsites

TRAILS BEFORE RESTORATION





TRAILS AFTER RESTORATION

to parking lots, outhouses, water sources, hitch rails, and main trails. A confusing tangle of pathways may meander over a heavily used area.

A goal of many land managers is to determine the best route through an area, enhance a single trail to carry all traffic, and then restore the rest of the area by closing and revegetating social trails.

However, where there are too many campsites or campsites in inappropriate places, agency personnel may wish to close certain sites and restore their natural appearance. Volunteers can create visual barriers that will discourage people from camping where they shouldn't. Loosening compacted soil and transplanting vegetation will help damaged areas recover.

Inappropriate Campsites

Wherever people camp, the concentration of human activity in a small area may injure vegetation and soil. Gathering kindling, building open fires, and parking vehicles or picketing livestock can further scar the land.

Many agencies and organizations encourage people to camp in small groups, cook over stoves rather than fires, and avoid digging ditches around tents. While these no-trace camping methods lessen the potential for environmental damage, the most important decision campers make is choosing an appropriate site in the first place.

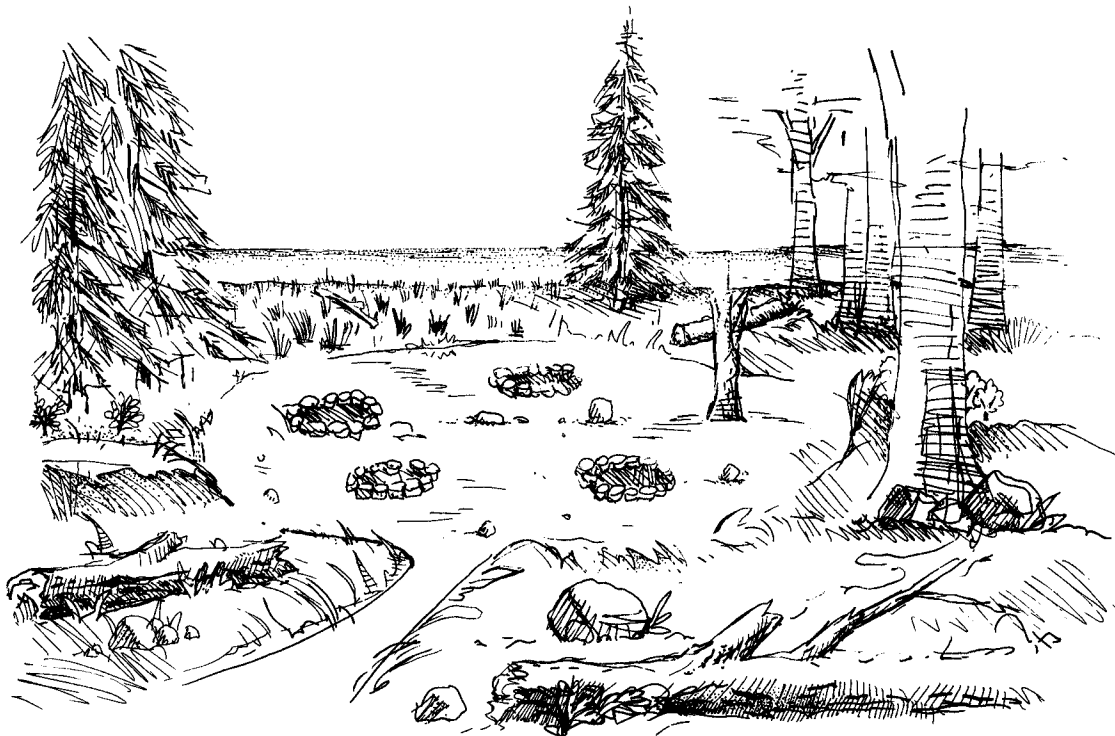
Heavily used campsites often are so devoid of vegetation that more camping on them will cause little additional damage. Conservation professionals may encourage people to continue using those campsites as a way of protecting undamaged vegetation elsewhere.

STEPS IN RESTORATION AND REVEGETATION

As with any other kind of conservation project, resource managers and TRAIL Bosses should do careful planning well before a group arrives at a restoration work site. The planning process will help determine attainable goals for a group and can increase the environmental education opportunities for volunteers.

Study the Area

During the pre-project site visit, determine the extent of damage and the causes. Consider the soil type, the amount of moisture it receives, the length and timing of the growing season, and the kinds of plant communities native to the area. Estimate the amount of time volunteers are willing to devote to improving



CAMPSITE BEFORE RESTORATION

the area. Are they interested in a long-term, adopt-an-area commitment that will include regular visits to the site? Or are they more interested in a one-time project without much followup?

Provide Options for Human Activity

Attempts to restore vegetation will not be effective if people continue to trample and compact newly repaired sites. One solution is to provide alternative routes and sites that are attractive enough to persuade people to use them rather than the areas undergoing restoration.

Loosen Compacted Soil

With shovels, garden forks, Pulaskis, or picks, volunteers can loosen the top inches of soil in barren areas. Loosen but don't turn the soil—leave the topsoil in place.

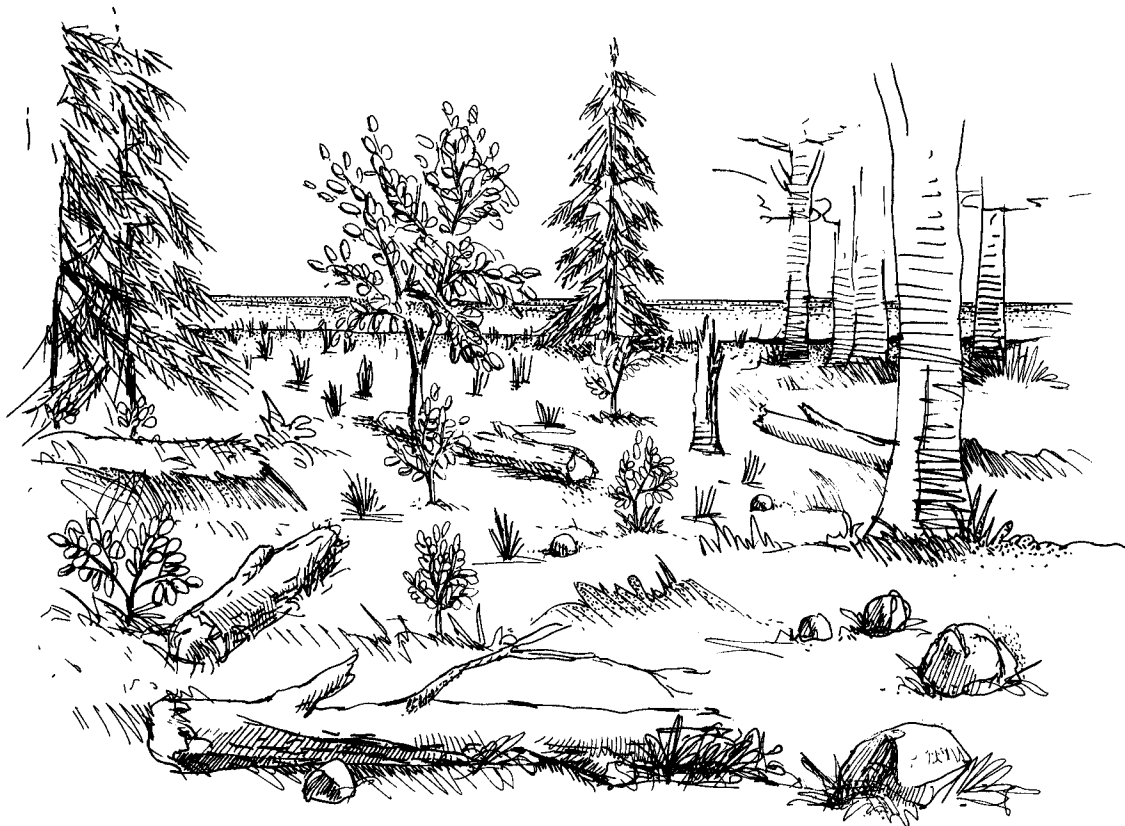
Loosened soil is an inviting bed for seeds drifting in from surrounding vegetation. Watering the soil during the summer may further encourage growth. You also can scatter leaves on the loosened soil to create a mulch that will enrich the soil and protect seedlings from drying out or being eaten by animals.

Loosening soil may be inappropriate in areas especially susceptible to erosion by water and wind, or in some mountainous regions where soil is fragile and thin. Before beginning this or any other restoration efforts, closely consult with resource managers to plan projects that truly benefit the environment.

Install Barriers and Camouflage

Visual barriers are an important part of restoration work. Their purpose is to discourage people from entering places you don't want them to go, while making those areas look as natural as possible. You often can use materials close at hand to camouflage revegetation sites and give them time to heal.

Install rocks, logs, and other inanimate objects in the site, placing them similar to the way they appear in the surrounding terrain. Transplant native species, especially prickly or spiny varieties such as cactus and devil's club. Allow your efforts to spill into undisturbed areas to help erase the boundary between a repaired site and the environment around it. Step back and examine what you have done. Make adjustments, then stand back for another look. Persist until your restoration work blends convincingly into its surroundings.



CAMPSITE AFTER RESTORATION

Use the same approach to close and restore unwanted trails. The temptation may be simply to throw armloads of sticks into an abandoned trail, but the result is usually a long, obvious windrow of dead brush. Instead, blend rocks, brush, and transplanted vegetation into the loosened tread to block access to the old trail in a way that does not draw attention to itself.

Other Barriers

Meadows, streambanks, and other revegetated areas may not lend themselves to the subtleties of camouflage. It may be necessary to protect repaired sites by encircling them with string and stakes. Educate the public by putting up signs that explain the work and ask visitors to stay off new vegetation to allow the area to heal.

Transplanting

Transplanting bushes, clumps of grass, and saplings into loosened soil can speed the healing of a restored area. The success of transplanting depends upon knowledge of local vegetation, proper planting times and methods, and a commitment to ongoing plant care.

In many regions, autumn is the best time to transplant. Most vegetation is becoming dormant then, and will be less affected by the shock of being moved. Transplanting in late spring and summer can stress plants, especially when most of their energy is being devoted to the production of flowers, seeds, and new roots.

Transplanted clumps of grass often thrive in new locations. Select native species from surrounding plots so that the new vegetation taking root will be the same as what was there before trampling occurred. Pay attention to the conditions at potential donor sites; take plants only from those spots that are similar to the restoration area in terrain and amount of sunlight. If, for example, plants from the shade of a moist forest are transplanted to the edge of a dry, sunny meadow, they are not likely to survive.

Roots exposed to the air are in danger of drying out. Before you dig up a plant that you intend to move, excavate the hole that will receive it and pour in some water and perhaps a mixture of vitamin B¹ and a natural fertilizer such as fish meal. Carefully remove the plant from its original location and immediately transplant it in the new hole.

Some restoration efforts include propagation of greenhouse stock for transplanting, especially for damaged alpine areas where

fragile native vegetation grows very slowly. Volunteers and TRAIL Bosses may become involved in the year-round activities of agency greenhouses—planting seeds, starting cuttings, fertilizing, watering, and wintering parent stock, and preparing plants to be moved.

PLANTING TREES

Planting a tree encourages volunteers to take long-term responsibility for another living thing. Many trees will not reach full maturity within the lifetimes of the people who plant and care for them. Tree planting is thus an act of generosity to the present and of faith in the future. As group members act in the best interests of their world today, they also are improving the environment for years to come.

To be of lasting value, tree planting must be done correctly. Selecting the wrong kinds of trees, planting them in the wrong locations, or neglecting trees after they are in the ground does a disservice to the trees, the volunteers who plant them, and the people who must deal with the trees in the future. The solution, of course, is careful planning.

Gathering Information

Talking with nursery workers, gardeners, city officials, and resource managers will allow TRAIL Bosses and group members to learn why trees are important and why many areas would benefit by having more. The experts might suggest specific places where groups can plant and care for trees.

Wherever trees are to be planted, increase the chances of success by answering the following questions:

1. Has permission been obtained from landowners or resource managers to plant on the selected site?
2. What species of trees should be planted? Are they suitable for the soil, climate, and location?
3. Is the planting site free of overhead and underground utility lines? Is neighborhood, city, or agency approval required before planting can occur?
4. Who will furnish the trees? Agencies may supply seedlings to be planted on public lands. Organizations, landowners, and interested businesses might fund the purchase of young trees.

5. Planting requires shovels, buckets, water, mulch, and sometimes stakes and padded wire. Where will volunteers obtain those items? Can they be borrowed or donated?
6. Who will teach TRAIL Bosses and group members proper planting techniques? Always involve an experienced gardener, forester, agency professional, or other knowledgeable person to provide guidance until you have gained the skills to offer that leadership.
7. Is your group willing to care for the trees after they have been planted?

Planting

Trees to be planted may range in size from 12-inch seedlings to saplings more than 6 feet tall. Whatever its size, a tree's roots probably will be protected by plastic or burlap, or enclosed in a bucket or box. Keep young trees in a cool, shaded location to prevent them from drying out before planting.

Dig a hole only deep enough to hold the roots and, if it has one, the ball of soil surrounding the roots. Loosen the sides and bottom of the hole so that tiny roots can more easily push into the soil.

If the tree is in a pot or other container, remove it and gently straighten any twisted roots or those growing around the root ball. Ease the tree into the hole. The crown at the top of the roots should be even with the surface of the ground. See that the tree is standing straight, then push loose soil around the roots and press it down firmly. Cover to the crown where the roots and tree trunk meet, but no deeper.

After the hole is filled, shape extra soil into a dam around the tree. Soak the soil with water, then soak it again. A newly planted seedling needs several gallons of water. A larger tree can require 10 gallons or more. If the tree is drooping, use stakes and padded cord or wire to give it temporary support.

Cover the ground around the base of the tree with several inches of wood chips, composted leaves, straw, grass clippings, or sawdust. Mulch holds moisture, enriches the soil, and discourages other plants from competing with the young tree. Spread mulch as far as the branch tips of the tree and replenish it every year until the tree is well established.

Following Up

One of the pleasures of planting trees is enjoying their long-term care. Resource managers can give volunteers guidance on when and how to water, mulch, prune, and straighten trees. Group members should plant trees only if they are willing to look after them.

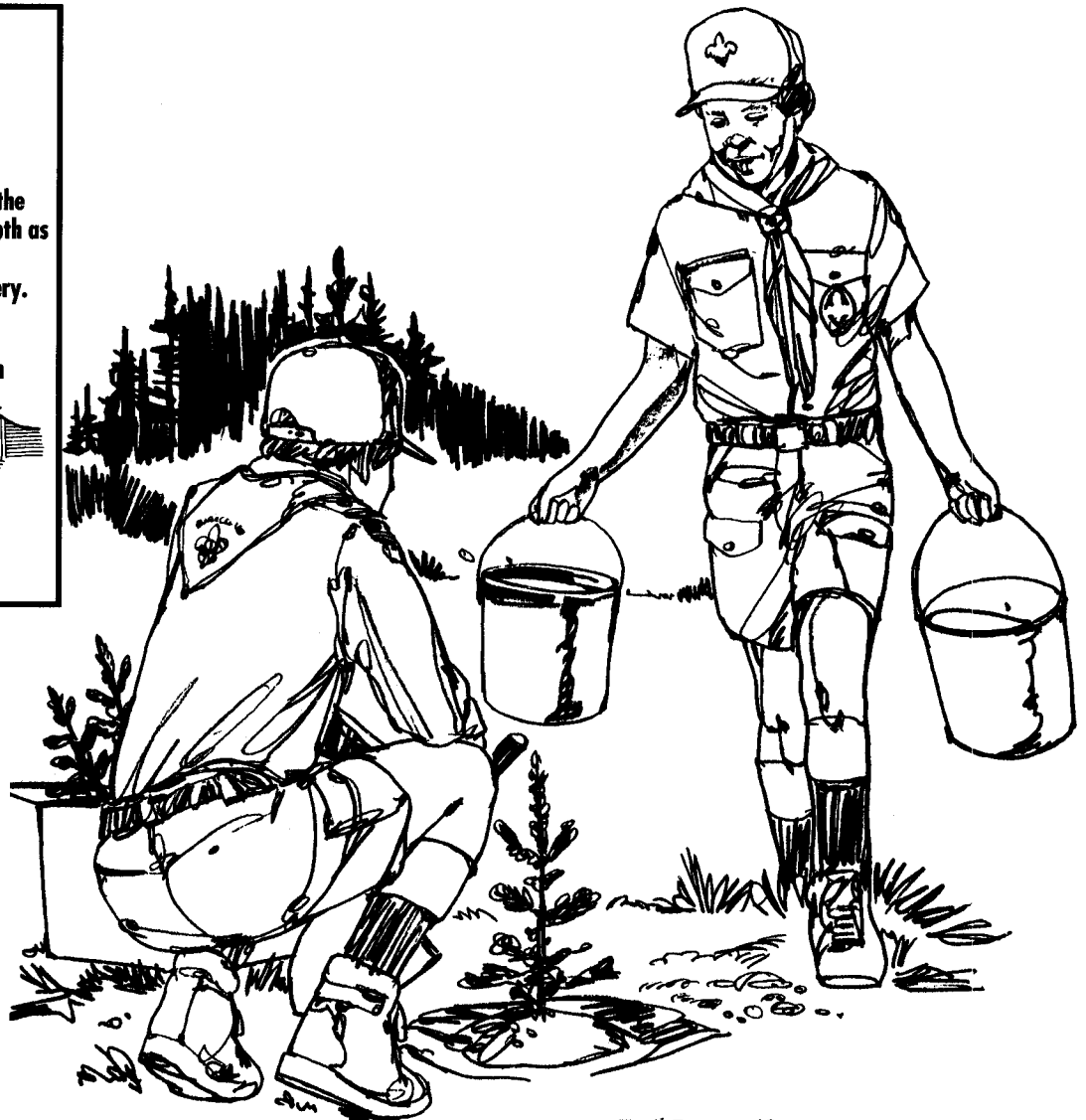
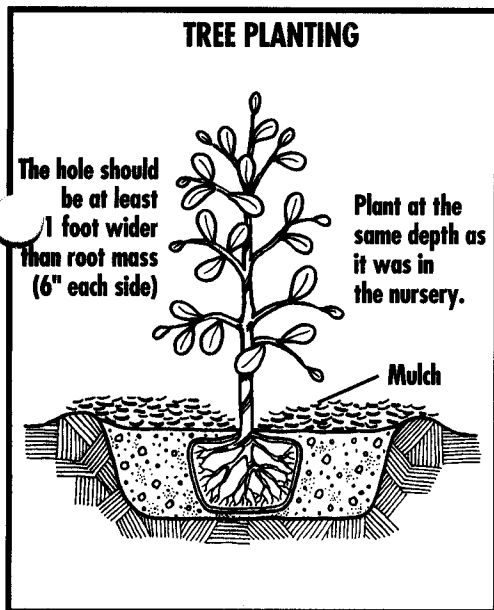
WORK PROJECT NOTEBOOK

Whatever the focus of your group's efforts, a record of what you have done and how well it has succeeded is an essential part of revegetation and restoration work. Include "before" and "after" photographs of repaired areas. When coupled with the written record of a notebook, repeating the photographs at intervals of weeks, months, and years will provide a valuable account of ongoing progress.

Informing the Public

Successful revegetation and restoration require the public's cooperation. The more that people learn about this work, the more likely they are to recognize and respect repaired sites and allow them to heal.

When people happen upon a group involved in a revegetation project, volunteers have a perfect opportunity to educate the public. Group members might take turns explaining the work they are doing and the importance it has for the land.



11. Archaeology and Historic Preservation

We often think of conservation as it relates to forests, meadows, seashores, waterways, and other resources of our natural heritage. But of great importance is the conservation of archaeological sites, historic buildings, cemeteries, battlegrounds, and other cultural resources. Those reminders of our collective history provide an exciting and essential window through which we can view and learn from the past.

Unlike many natural resources, the pieces of our cultural heritage are nonrenewable. Once they are gone, they and the lessons they might teach can never be replaced.

Partnerships between trained historians or archaeologists and groups led by TRAIL Bosses can help educate the public about the meaning and importance of cultural resources. Volunteers can do much to protect those

resources, restore weathered buildings, care for historic sites, conduct research, and develop ways to share the past. With careful supervision, volunteers may assist with archaeological work in the field, in museums, and in their communities.

THE IMPORTANCE OF CONTEXT

Archaeology is the scientific study of the lives and cultures of historic and prehistoric peoples. Through the investigation of artifacts found in place, archaeologists attempt to reconstruct past ways of life, to give a sense of order to the events of long ago, and to explain how and why changes occurred at specific locations.

The relationship of artifacts to their surroundings is called *context*. An archaeological site that has been undisturbed over the years is said to have retained its context. When all the



pieces are in their original places—that is, in context—archaeologists can reconstruct a complete picture of the past.

When an artifact is disturbed or removed without being properly recorded and then studied, that all-important context is disrupted. A piece is gone from its place in the historic puzzle, and the larger picture is much more difficult to understand.

The fragility and importance of context makes it clear that dealing with artifacts must be done only under the supervision of trained specialists. Otherwise, people hunting for arrowheads, digging for pots, looting burial grounds, and carrying away artifacts can destroy the context of thousands of years of history. So serious is this threat to our cultural heritage that it is against local, state, and federal laws to collect artifacts on public lands.

THE ROLE OF TRAIL BOSSES IN ARCHAEOLOGY

Every state has an archaeological society that encourages the public to learn how to protect archaeological sites. Each state also has a

state historic preservation officer who integrates local, state, and federal archaeological activities into an overall preservation plan.

TRAIL Bosses interested in involving volunteers in historic preservation will find local, state, and federal archaeological officials usually ready to discuss the opportunities that may exist for groups to learn about and enhance archaeological efforts in their areas. Consider a few projects that volunteer groups have completed:

- ◆ Build fences around archaeological sites to protect them from livestock and motorized vehicles.
- ◆ Present programs that educate the public about the appeal of archaeology and the importance of protecting the context of artifacts and sites.
- ◆ Research, design, and install signs that explain the meaning of archaeological sites and the public's responsibility to protect those areas.
- ◆ Help stabilize eroded sites and repair damage caused by illegal artifact collectors.
- ◆ Assist archaeologists with identifying artifacts; recording rock art; and locating, mapping, and excavating sites. This work may include cleaning and analyzing artifacts and writing reports.

HISTORIC PRESERVATION

Helping archaeologists protect and make sense of prehistoric sites and artifacts is not the only way volunteers can use their talents to illuminate the past. Many agencies, historical societies, and other organizations involved in keeping history alive may welcome the assistance of TRAIL Boss-led groups.

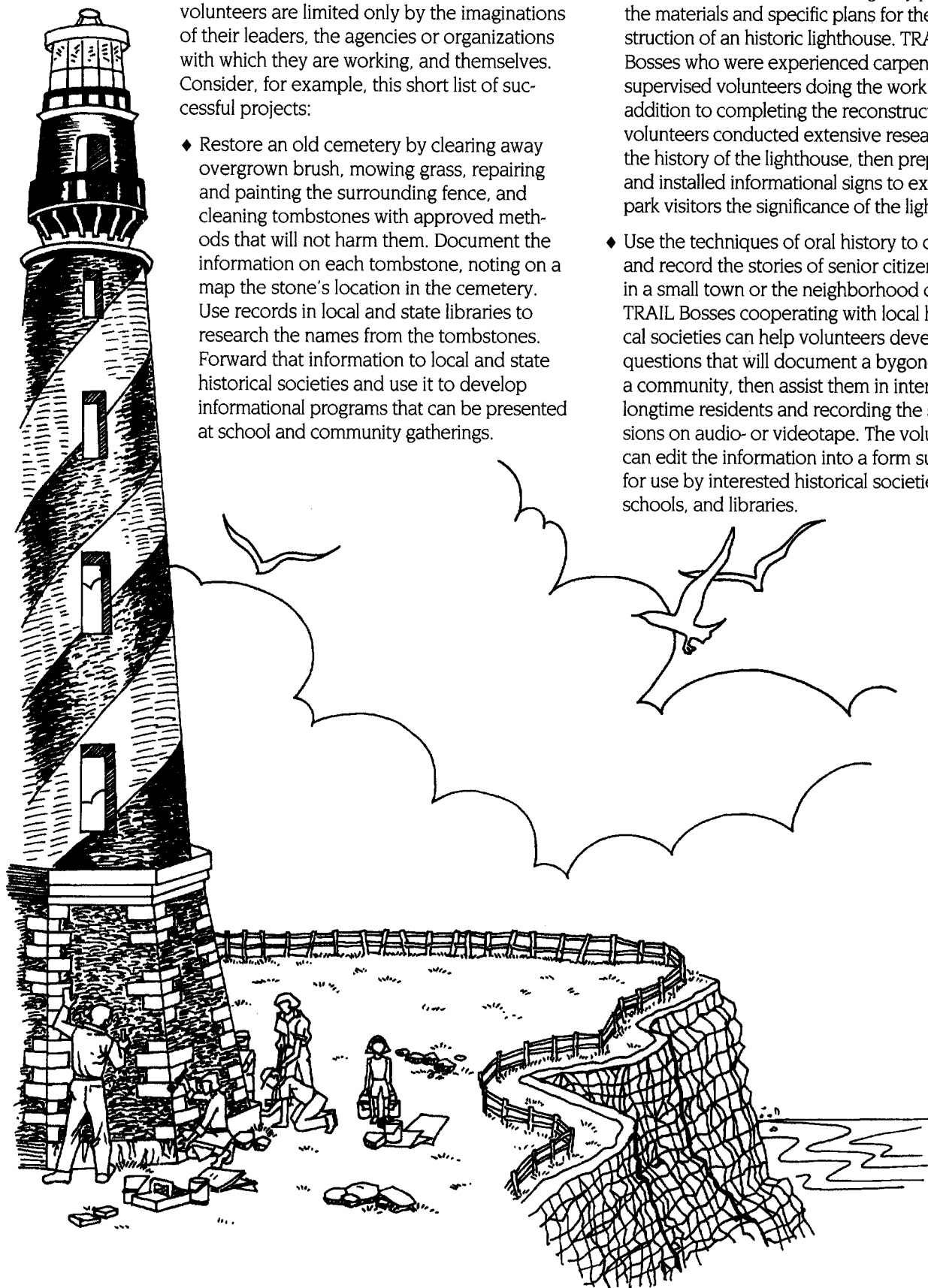
The kinds of work that volunteers can do will be partially determined by the skills they and their leaders bring to a project. Those with experience in carpentry might help stabilize the condition of historic buildings and return them to their original appearance. Those who enjoy doing research might use their talent to explore library records, prepare historic reports, and draft documentation to nominate sites for the National Register of Historic Places. Volunteers with theatrical interests might develop living-history presentations or educational programs to present in schools and at fairs.



The field of historic preservation is so broad that project opportunities available to volunteers are limited only by the imaginations of their leaders, the agencies or organizations with which they are working, and themselves. Consider, for example, this short list of successful projects:

- ◆ Restore an old cemetery by clearing away overgrown brush, mowing grass, repairing and painting the surrounding fence, and cleaning tombstones with approved methods that will not harm them. Document the information on each tombstone, noting on a map the stone's location in the cemetery. Use records in local and state libraries to research the names from the tombstones. Forward that information to local and state historical societies and use it to develop informational programs that can be presented at school and community gatherings.

- ◆ Stabilize or restore historic structures on public lands. In one case, a state agency provided the materials and specific plans for the reconstruction of an historic lighthouse. TRAIL Bosses who were experienced carpenters supervised volunteers doing the work. In addition to completing the reconstruction, volunteers conducted extensive research on the history of the lighthouse, then prepared and installed informational signs to explain to park visitors the significance of the lighthouse.
- ◆ Use the techniques of oral history to collect and record the stories of senior citizens living in a small town or the neighborhood of a city. TRAIL Bosses cooperating with local historical societies can help volunteers develop questions that will document a bygone era of a community, then assist them in interviewing longtime residents and recording the sessions on audio- or videotape. The volunteers can edit the information into a form suitable for use by interested historical societies, schools, and libraries.



12. Wildlife Management

All species of wild animals must have food, water, shelter, and space. When those are available in quantity in an area, a species will thrive. When one or more are in short supply, the populations dependent upon them will decline.

Not every species needs the same kinds or amounts of the four essential habitat requirements. Changing the quality or quantity of any of these components will improve conditions for some species, but may be detrimental to others. For example, clearing a portion of a forest can increase forage and open space for deer, but may reduce the number of dead snags that woodpeckers, owls, and squirrels require for their nests.

Whenever changes occur in an ecosystem, whether planned or not, the species composition of the local wildlife populations also will change. Some wildlife may be eliminated, some may decline, others may dramatically increase their numbers.

Conservation professionals entrusted with the regulation of wildlife strive to establish and maintain a diversity of habitats that can support many animal species. Much of their work involves policy decisions that seek to balance the needs of wildlife with hunting, livestock grazing, timber harvesting, construction, recreation, and other human demands for much of those same resources.

WILDLIFE ENHANCEMENT PROJECTS

The well-being of birds, fish, mammals, and other animals is so dependent upon the condition of the environment that any projects that improve an ecosystem will probably also enhance many wildlife populations. Group leaders can draw upon a variety of TRAIL Boss skills to supervise projects that will benefit wildlife.

Surveying

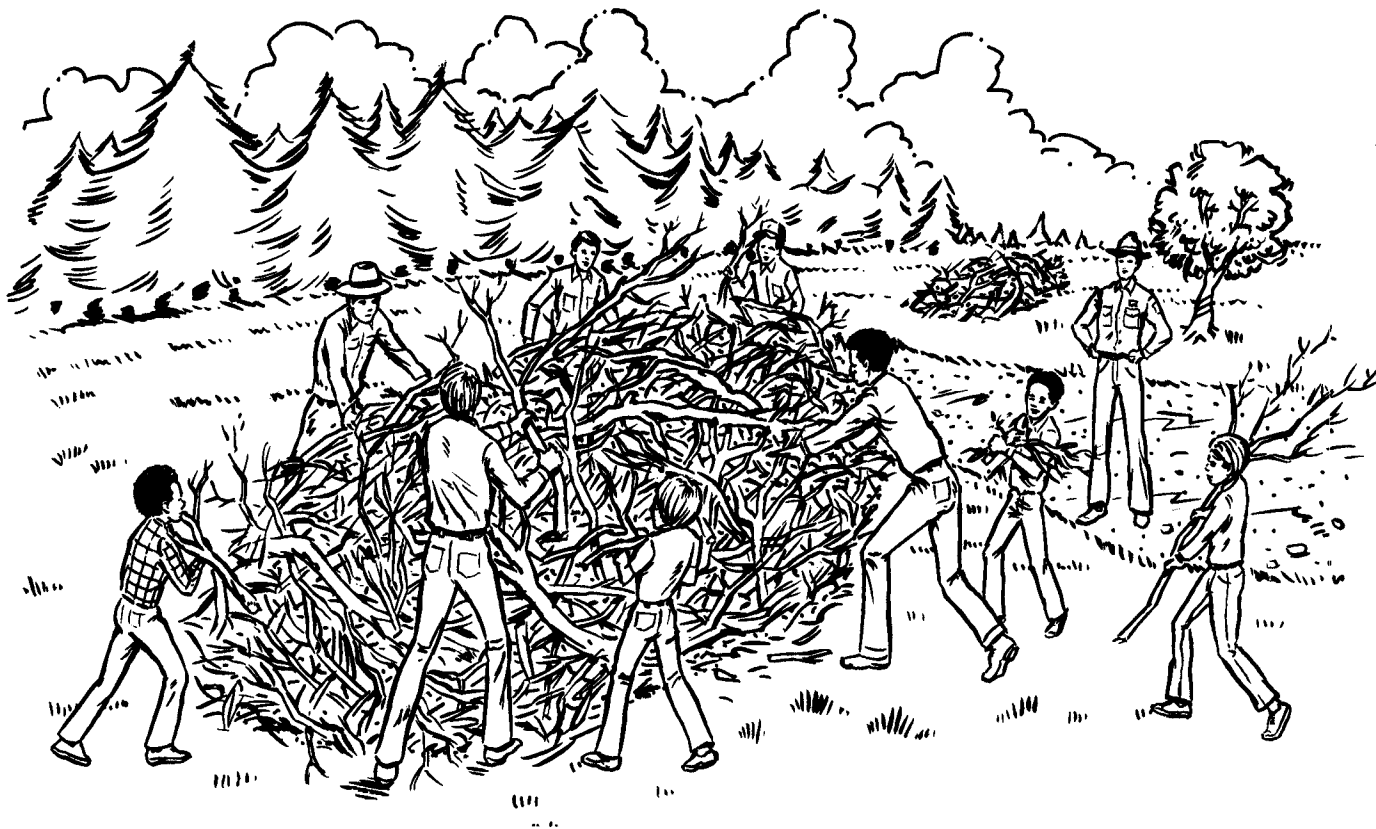
Volunteers might begin by preparing an inventory of the wildlife populations in an area. With guidance from TRAIL Bosses and wildlife

professionals, they can document the locations and numbers of various categories of reptiles and amphibians, songbirds, upland game birds, waterfowl, hawks and owls, game and furbearing mammals, nongame mammals, and threatened or endangered species. Based on numbers of sightings, volunteers can categorize the populations of various species as *abundant*, *occasional*, or *rare*. The information they collect will provide a baseline to determine long-term population trends.

Using aerial photos and topographical maps, volunteers also can make trips into the field to inventory and map the kinds of wildlife habitat found in the study area.

Drawing upon the species inventory and habitat mapping, conservation professionals can determine the practicality and method of improving conditions for wildlife. Some areas are best left alone. Others might be improved by the efforts of TRAIL Bosses and volunteers undertaking some of the following projects:

- ◆ Establish and maintain openings in a forest.
- ◆ Selectively clear away heavy underbrush and exotic vegetation to produce seedbeds for natural grasses, legumes, and shrubs beneficial to wildlife.
- ◆ Fence wetlands and woodlands to control excessive livestock grazing.
- ◆ Protect den trees and other nesting areas for birds, squirrels, raccoons, wood ducks, and other animals.
- ◆ Follow timber stand improvement practices that will ensure a diversity in the ages and species of trees and a mix of forest, brushy areas, and clearings.
- ◆ Plant conifers to benefit cottontails, grouse, and other small birds and mammals. Low branches provide shelter, while herbaceous vegetation growing between young trees supplies food.
- ◆ Encourage the growth of dense plant communities where ruffed grouse and other species can find cover any season of the year, especially in winter.



- ◆ Help resource managers protect forests, marshes, and fields from uncontrolled wildfires and aid in using prescribed burning to alleviate wildfire hazards and encourage natural succession of plant communities.

The results of habitat improvement projects are neither immediate nor dramatic. By its nature, wildlife is secretive and, to the unskilled observer, practically invisible. Resource managers and TRAIL Bosses may find that volunteers will be more motivated to work on long-term projects (revegetation, timber stand improvement, etc.) if they also do work that gives the satisfaction of immediate results—building brush piles, for example, or constructing birdhouses.

Brush Piles

Wild animals avoid areas where they cannot find shelter. Where the lack of cover makes an area unattractive to wildlife, volunteers can establish brush piles to substitute for dense, natural vegetation. Properly constructed, brush piles will provide small animals and birds with nesting habitat; protect them from rain, wind, snow, and heat; conceal them from predators; and encourage seed germination and plant growth.

The edges of fields, wetlands, and woods are promising locations for brush piles. They should be built about 5 feet high and 20 feet long using branches that might be gathered from nearby timber stand improvement projects or trail corridor clearing. A tall stump or rock in the center will extend the life of a brush pile by lifting it off the ground and slowing the process of decay.

Birdhouses

Many species of birds seek the hollows of trees as locations for their homes. Birdhouses increase the number of sites where birds are likely to nest. Well-made birdhouses also protect eggs and chicks from the elements and from predators.

Local bird enthusiasts and resource managers can guide TRAIL Boss groups in choosing birdhouse designs appropriate for birds of their areas. The following design is an example of a house that is easy to build and inviting to many kinds of birds in urban, suburban, and rural settings.

1. Begin with a $\frac{3}{4}$ -inch board 6 $\frac{1}{2}$ inches wide and 5 feet long, or use pieces of scrap wood. Mark off the box parts with a pencil, tape measure, and carpenter's square.

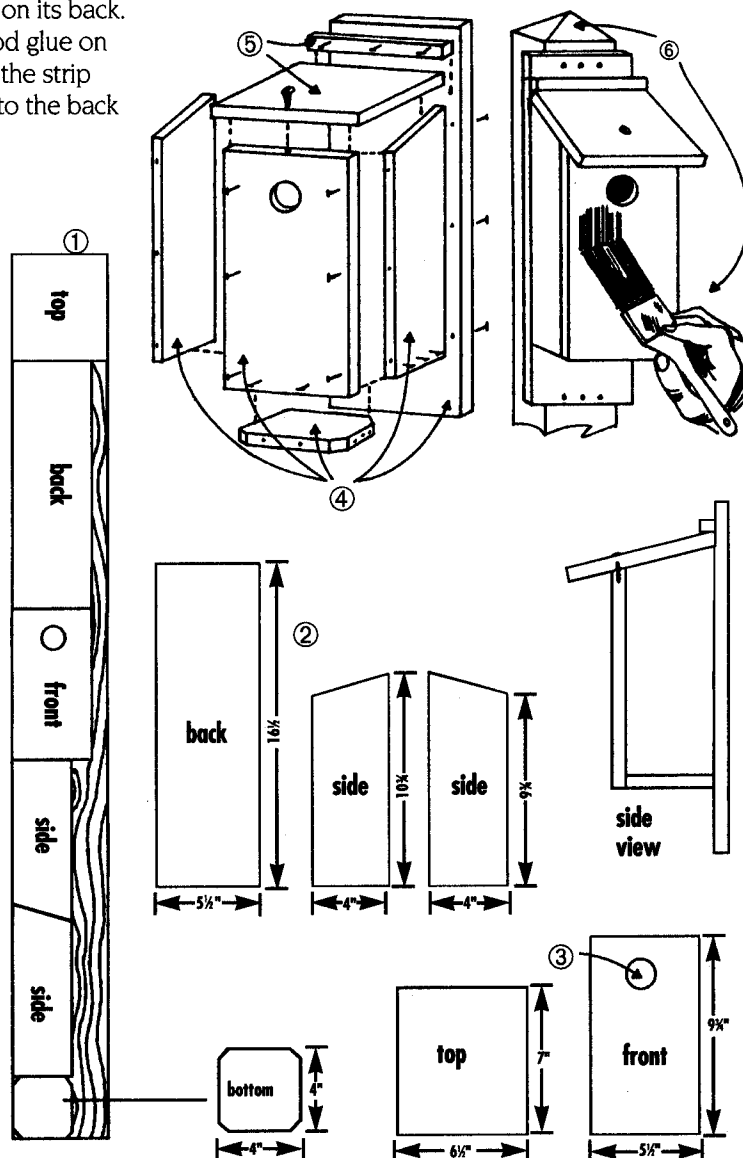
(Measure the three straight edges on each sidepiece first, and the angled edge will be correct.)

2. Cut out the pieces. Saw off the corners of the bottom piece to assure good drainage and airflow in the birdhouse.
3. Drill a 1½-inch entrance hole 2 inches below the top edge of the front piece.
4. Nail together the bottom, sides, and front pieces with small nails. Center this three-sided box on the back piece. About 3 inches of the back piece will extend above and below the nest box.
5. Place the top piece on the box. Position a 1-inch × 1½-inch × 5½-inch strip above the top piece and mark its position on the back board with a pencil. Remove the top and lay the box on its back. Spread wood glue on the back of the strip and stick it to the back

board. Nail the strip in place with several small nails. The top will fit snugly under the strip. Secure it with a washer and wood screw that goes through the top piece and into the top edge of the front.

6. If you paint the birdhouse, use nontoxic paint free of creosote or lead that could harm birds. Do not paint the inside of a birdhouse or the edges of the entrance hole.

Late winter and early spring are the best times to put up birdhouses. Mounted on fence posts or trees, they should be oriented so that entry holes face away from prevailing winds that might blow rain inside. Remove the top after each nesting season and clean the interior to prepare it for the following year's birds.



13. Riparian Area Conservation

Defined as land directly influenced by permanent water, riparian areas are the green zones along the banks of streams and rivers and around springs, bogs, wet meadows, lakes, and ponds. They are among the most richly diversified ecosystems. Their abundant vegetation purifies water and eases the effects of droughts and floods. They also provide essential habitat and nourishment for wildlife, fish, and many other organisms both in and out of the water.

No ecosystem remains static for long. Changes in water depths and the shapes of shorelines and stream channels drive the natural evolution of riparian areas. When natural

processes are disrupted by activities such as concentrated recreational use by humans or heavy grazing by livestock, riparian areas may be severely damaged by erosion, pollution, and the loss of vegetation and wildlife.

TRAIL Boss groups can work in partnership with resource managers to monitor conditions in riparian areas, then repair many kinds of damage and limit future degradation. A project as simple as strengthening an old beaver dam can significantly enhance wildlife habitat. So can the installation of nesting boxes designed to accommodate species that frequent a particular riparian area. The ability of riparian areas to support



wildlife can sometimes be augmented with the construction of small dams to slow stream currents or enlarge and preserve marshes. Other valuable projects include building revetments to protect streambanks from erosion and putting up fences to exclude riparian areas from overgrazing.

PLANNING PROJECTS IN RIPARIAN AREAS

As with all conservation work, TRAIL Bosses planning projects in riparian zones should always rely heavily upon the advice of resource managers familiar with local conditions. Ecosystems vary greatly from one part of the country to another. Solutions that work well in one riparian zone may be useless or even detrimental somewhere else. Since riparian repair often involves public waterways, TRAIL Bosses and resource managers may need to obtain authorization from local, state, or federal agencies before beginning projects.

RIPARIAN REVEGETATION

Vegetation plays many essential roles in the vitality of a riparian area. It deters erosion by binding soil in place. It provides food for fish, insects, and terrestrial wildlife and gives them places to rest, to breed, and to hide from predators. Its shadows can help regulate water temperature. Its networks of roots can play a part in filtering sediment from streams and lakes.

Riparian vegetation can be improved by planting desirable species to increase the densities of existing plant communities or to replace plant populations that have been disturbed or destroyed. As a general rule, using native species gives the best results.

The restoration methods most appropriate for volunteer projects are using cuttings, transplanting dry root stock, and planting seeds. These may be available from nurseries or Soil Conservation Service plant material centers or, with guidance from resource managers, gathered near planting sites.

Cuttings

Willows, cottonwoods, and similar woody species can be effectively reestablished in a riparian area by using cuttings. Begin by collecting native cuttings from sites as near the

project as possible, but choose donor sites that will not be harmed significantly by the loss of the cuttings.

Harvest each cutting by pruning it at a 45-degree angle. When replanted, the top of each cutting should stand 8 to 15 inches above the ground while its butt end must be buried deeply enough to touch soil that is always wet. Cuttings survive best if they are transplanted immediately, though it is possible to store them for up to several days in buckets of water containing a commercial root-growth hormone.

Transplanted Root Stock

The methods of planting described in the Revegetation and Restoration chapter also apply to transplanting of saplings, shrubs, and grass clumps in riparian areas. Usually, the most appropriate vegetation to transplant is gathered from nearby locations that are similar in terrain and growing conditions to the area undergoing restoration.

Seeding

Grasses and broad-leaved annuals may be used to help stabilize gently sloping streambanks. Seeds should be carefully selected to produce plants that are suitable for the area and, ideally, native to the location. In most parts of the country, seeds should be sown in autumn as vegetation is going dormant or in early spring at the beginning of the growing season. Volunteers can broadcast seeds by hand or with a seed spreader. It's good to rake the seeds into the soil to improve their chances of germinating.

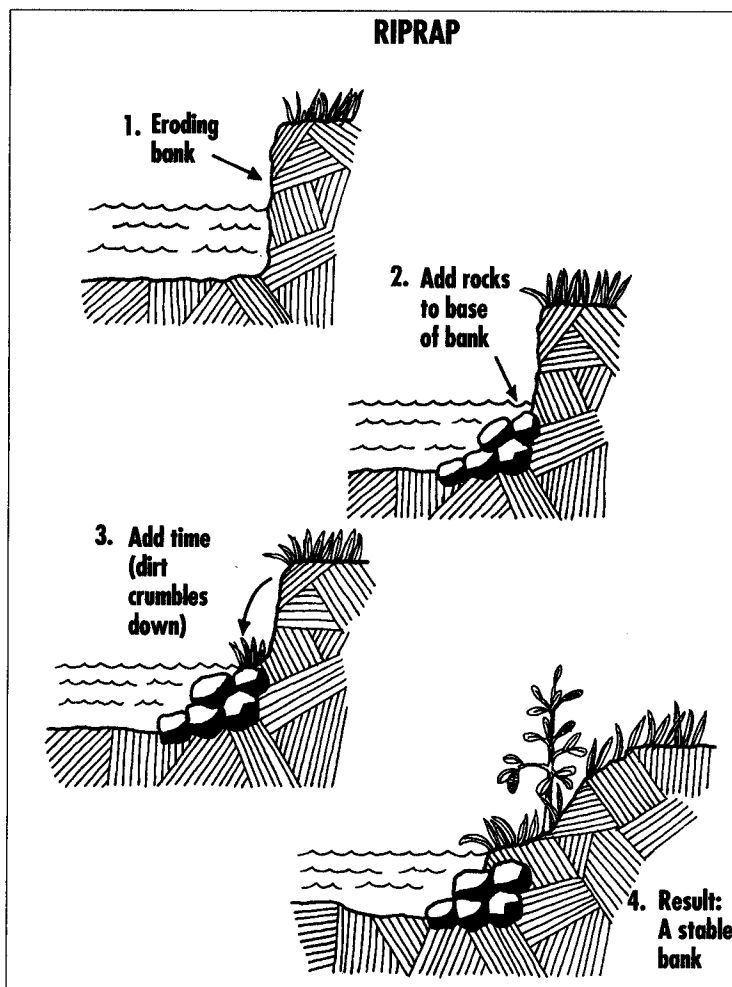
FENCING RIPARIAN AREAS

Fencing a riparian area is an effective way to protect new plantings or seedlings, to restrict access of livestock to streambank vegetation, and to control the flow of human traffic through the area. The kind of fence to be constructed should be decided in consultation with conservation professionals. Take into consideration terrain, climate, type of riparian zone, wildlife migration patterns, visual impact, livestock and recreational uses, the need for public entrances such as stiles, and water access points for livestock and large wildlife.

As a rule, fences should not be located in a riparian zone itself. Wildlife might be hindered in its movements through the area, and that part of the zone outside the fence would be subject to the overuse or abuse the fence is meant to stop. Improperly placed fences also may trap debris during periods of high water, leading to upstream flooding.

RIPRAP

Riprap can be used to curtail erosion on the outside bends of small streams, generally those less than 12 feet across. Place rocks along the base of the eroded bank, using enough stone to slope gently up the bank from the stream bottom to a point above the level of normal flood flow. Over time, the bank above the riprap will reshape itself as soil crumbles from steep sections. Seeding the bank or transplanting grass clumps, saplings, or willow cuttings will speed the process of stabilization and healing.



(Source: *Stabilizing Eroding Streambanks in Wyoming: A Guide to Controlling Bank Erosion in Streams*, Wyoming Game and Fish Department, N. Allen Binns, 1986)

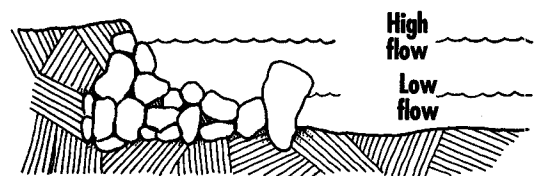
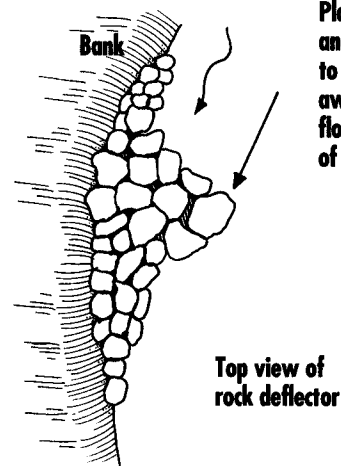
ROCK DEFLECTORS

Deflectors built of rock can divert water from eroding streambanks and direct flows toward more suitable channels. Deflectors provide hiding and resting places for fish. Rather than acting as dams that abruptly change water direction, deflectors built in a triangular shape gently turn water away from the bank.

Rocks used in deflectors should be large enough to withstand the force of high water. Place the largest rocks on those parts of the structure most likely to be affected by stream flow.

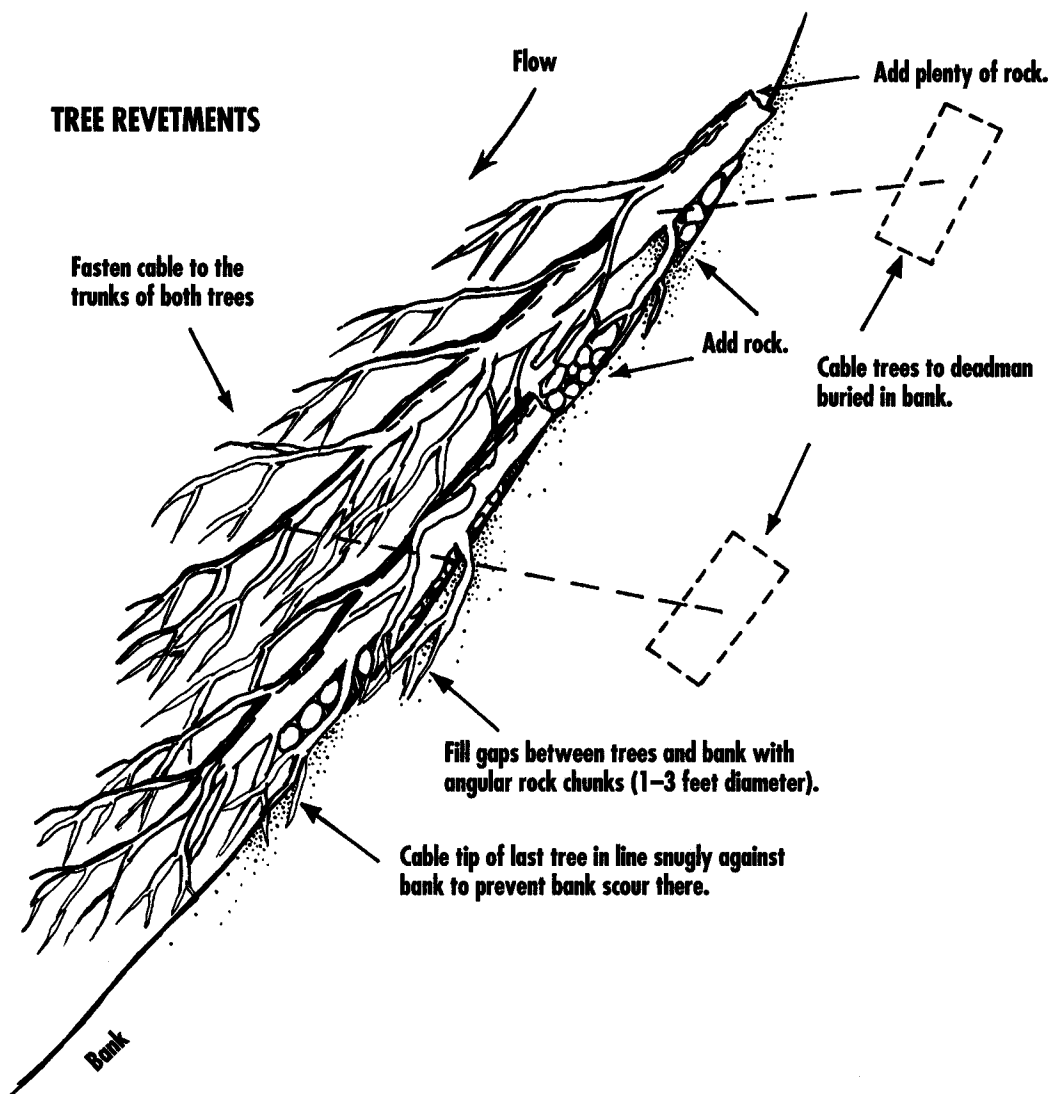
A deflector should be no more than a few inches higher than the normal water levels, but the point where it connects with the bank should be protected with riprap laid higher than flood stage. High water and debris will flow over the deflector without seriously altering the current while the riprap will shield the shoreline from erosion.

SIMPLE ROCK DEFLECTOR

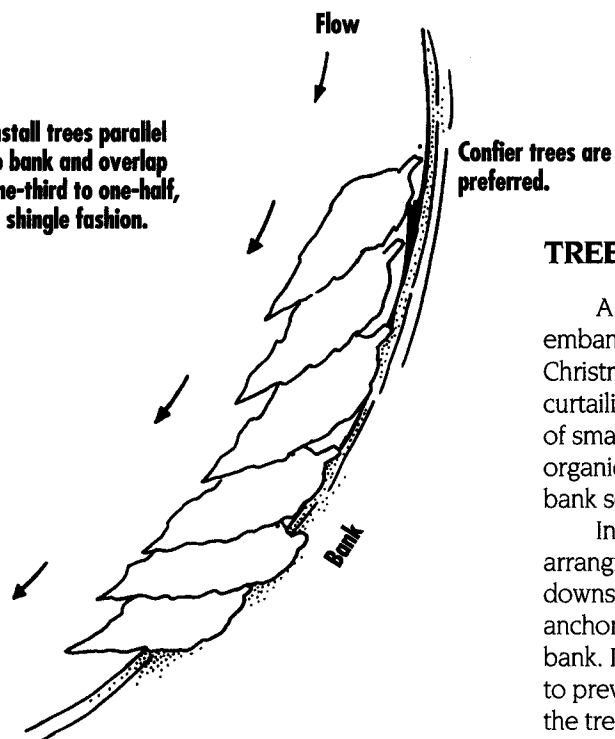


(Source: *Stabilizing Eroding Streambanks in Wyoming: A Guide to Controlling Bank Erosion in Streams*, Wyoming Game and Fish Department, N. Allen Binns, 1986)

TREE REVETMENTS



Install trees parallel to bank and overlap one-third to one-half, in shingle fashion.



TREE REVETMENTS

A *revetment* is a facing used to protect an embankment. Revetments made of discarded Christmas trees can be especially effective in curtailing bank erosion on the outside curves of small streams. The branches trap silt and organic debris, slowly building up the stream-bank so that vegetation can take root.

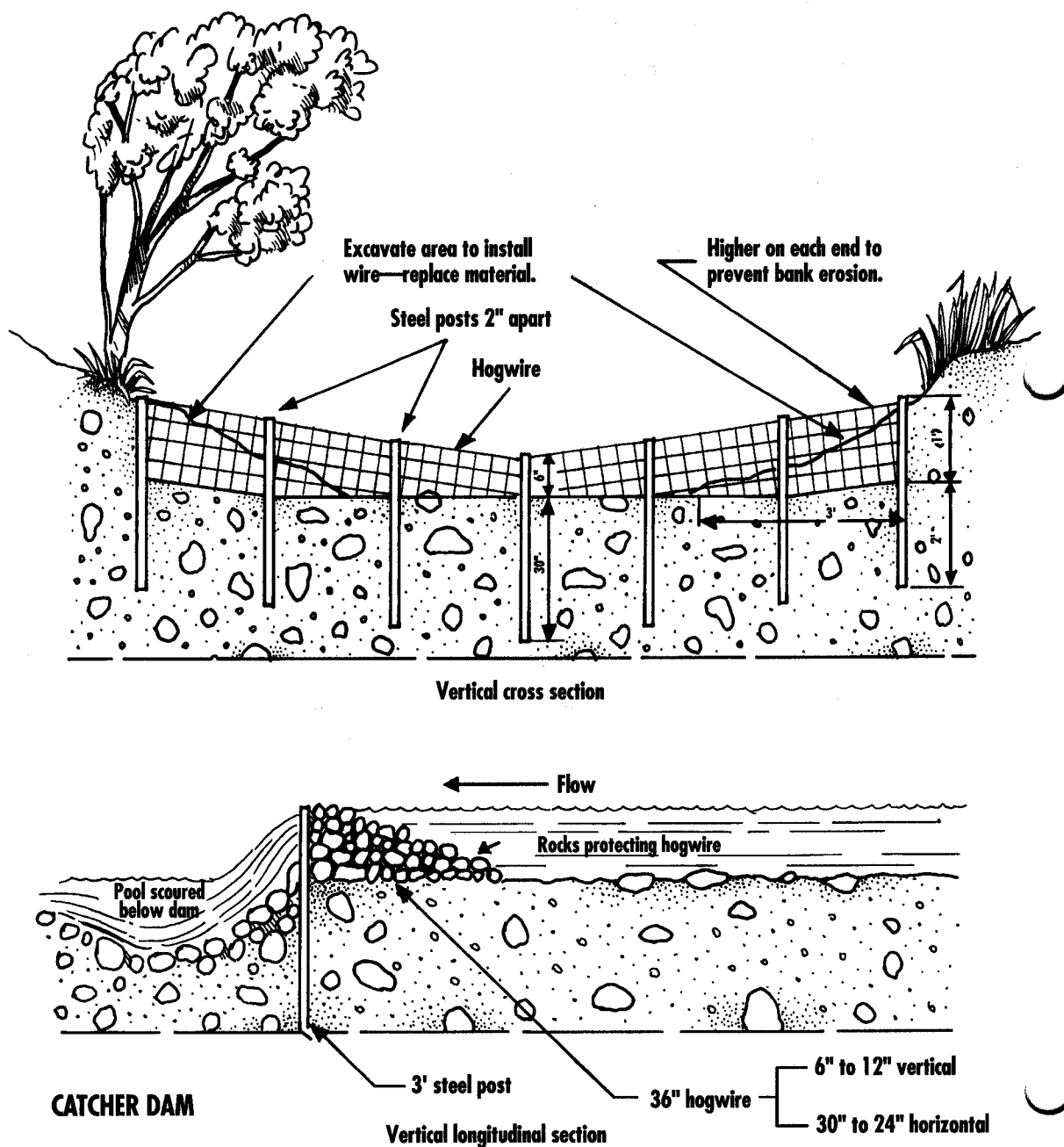
Install one tree per yard of embankment, arranging the trees so that their tops point downstream. Use wire to fasten the trees to log anchors called *deadmen* buried in the stream-bank. Place riprap rock all along the revetment to prevent the current from scouring behind the trees.

(Source: *Stabilizing Eroding Streambanks in Wyoming: A Guide to Controlling Bank Erosion in Streams*, Wyoming Game and Fish Department, N. Allen Binns, 1986)

CATCHER DAMS

A variety of structures can be installed in low-velocity streams to allow sediment to settle and form natural basins that are inviting to aquatic and riparian vegetation, and to wildlife and fish. These structures may be as simple as a line of rocks placed across current or a log embedded in the streambed perpendicular to the shore. Low wire fences sometimes are positioned to catch debris, as are wedge dams made of logs that have been notched, fitted together and backed with wire and rock.

Whatever design is deemed appropriate by conservation professionals, locate catcher dams on straight portions of streams where tall vegetation on the banks can provide cover and shade. Securely anchor the dams in the streambanks to prevent them from washing away in high water. Check them several times a year to perform maintenance that will keep them in good working condition.



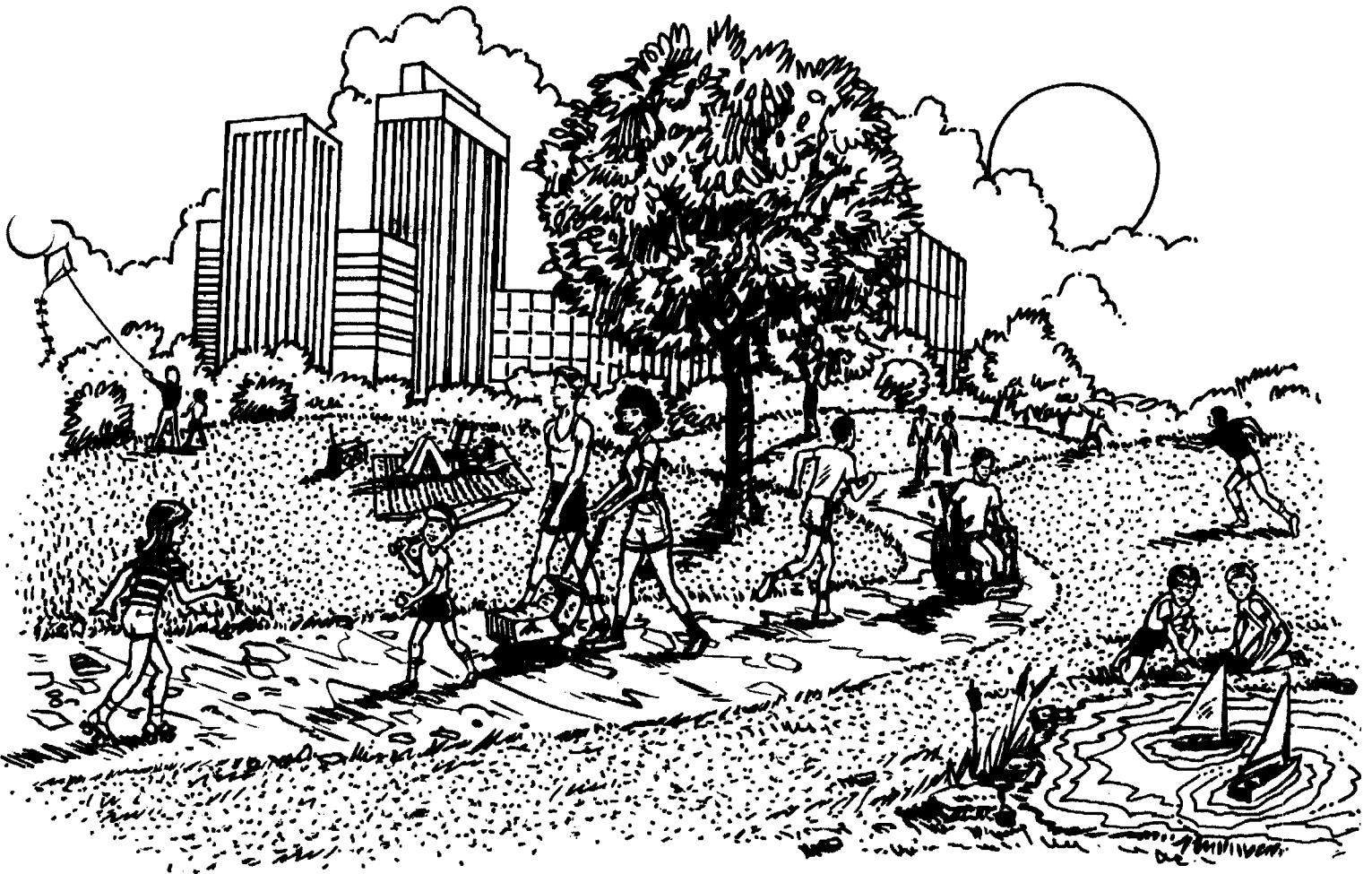
(Source: U.S. Forest Service)

14. Trail Maintenance and Construction

Trails are an essential means of access for work and recreation on many public and private lands. Strollers and picnickers enjoy pathways in city parks. Hikers and campers use trails to travel far from highways. People who enjoy fishing and hunting take advantage of trails leading into areas as appropriate for those sports. Rangers follow trails to patrol remote territory and make back-country rescues. While many trails are limited to pedestrian use, others are open to people on horseback, mountain bicycles, snowmobiles, and motorized dirt bikes.

Good trails are designed with visitor safety and satisfaction in mind. They also protect the environment by encouraging users to stay within trail corridors where human impact can be monitored and damage to surrounding natural resources minimized.

Consider, for example, a trail leading a short distance from a parking lot to a scenic overlook. If the trail is smooth and the grade gentle, many people can enjoy the experience





of going to the overlook. The trail will be inviting to even more users if it has been surfaced with asphalt, concrete, or wooden decking and is wide enough to accommodate visitors in wheelchairs. Railings and directional curbing can make the trail manageable for people with visual impairments. Informational signs can expand all visitors' understanding of the environment around the trail. The signs may be in a variety of languages, and Braille.

Now consider a trail that leads deep into a rugged wilderness. It probably will be much narrower than the scenic overlook trail, and its surface rougher. Streams along the route may have no bridges. Roots and rocks may further limit trail access to those people able to climb over and around natural obstructions. Instead of following signs, travelers may need to rely on their maps and their wits to find the way.

While these trails are very different from one another, they also share much in common. Both safeguard the environment by funneling human use along a well-defined tread. Each trail has been constructed and maintained to serve certain user groups. While backpackers would not be satisfied with the short distance

of the overlook trail, visitors with limited time, energy, or physical ability might have difficulty getting far up the wilderness pathway.

By having a variety of trail types in a region, resource managers can satisfy the needs of many sorts of visitors. Conservation professionals also can enhance the environment by encouraging people to use some trails and avoid others, thereby controlling the flow of human activity into sensitive areas.

Of course, trails are inviting to use only when they are in reasonably good condition. A route overgrown, eroded, and cluttered with deadfall will attract only the hardest hikers.

Maintaining trails is among the most labor-intensive responsibilities of many land management agencies and organizations. Unfortunately, demands on personnel and financial resources often limit the amount of trail maintenance many professional staffs are able to complete.

Volunteer involvement in maintenance projects allows people who enjoy trails to care for the pathways they use. By providing experienced leadership in completing repairs, TRAIL Bosses can help their groups and the agencies make the most of trail work opportunities.

ANATOMY OF A TRAIL

The ideal trail lies lightly on the land. It follows the contours of the terrain, curving around hillsides, dipping into valleys, and climbing at reasonable grades.

The initial designing and surveying of a trail is usually done by resource managers. Their intent is to lay out a trail that will:

- ◆ Lead people to destinations they want to reach, using routes that make getting there an enjoyable part of the experience
- ◆ Protect the environment by encouraging users to stay on the trail and thus limit their impact
- ◆ Withstand the general wear and erosion caused by rain, melting snow, and trail users

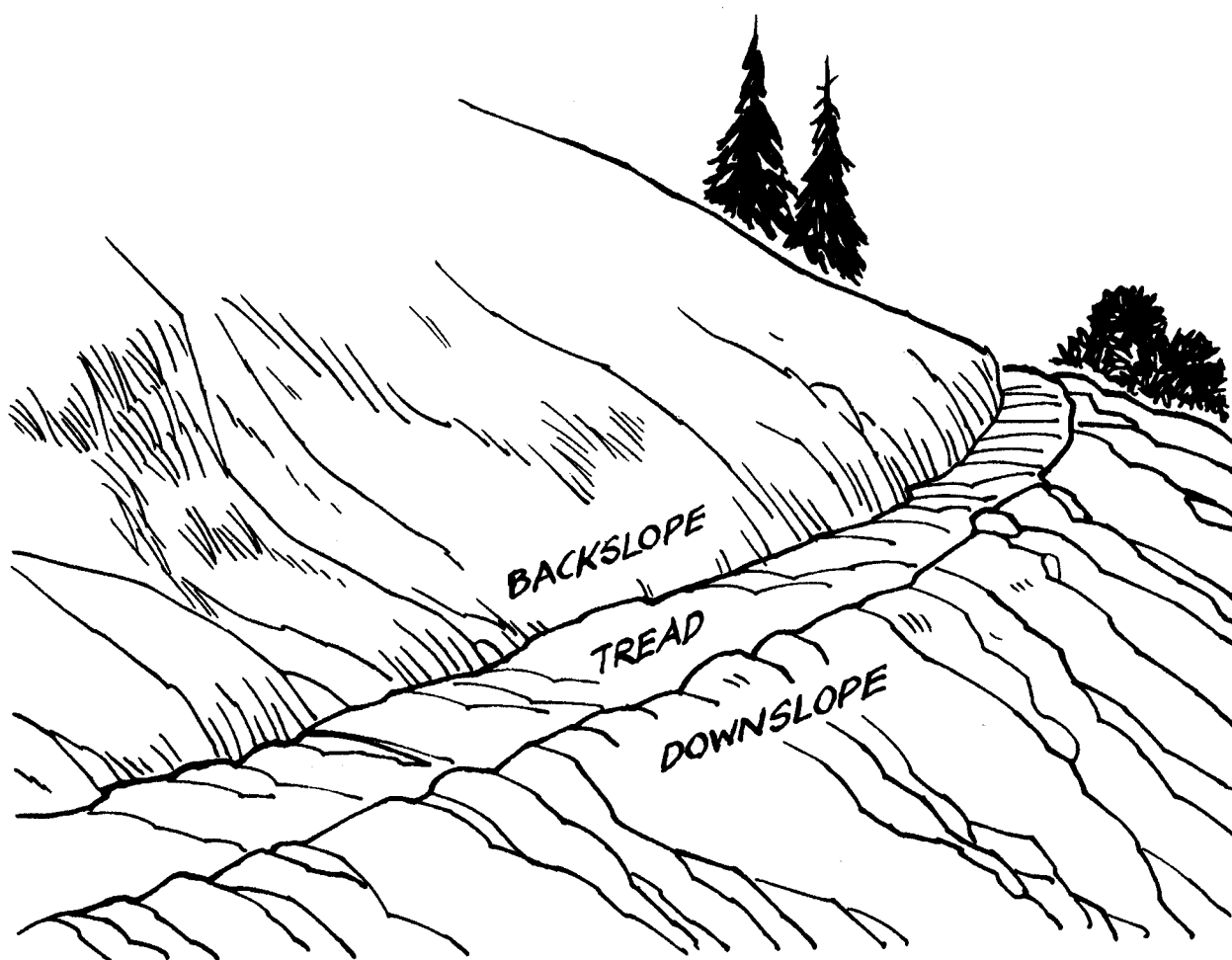
A goal of trail builders and maintainers is to do their work so well that travelers will be aware of the natural wonders unfolding

around them, but barely notice the pathway on which they are walking. The best trails provide access to the outdoors without drawing attention to themselves.

The *tread* of a trail is the part upon which users travel. Trails designed primarily for hikers have a tread 18 to 24 inches wide, while those used by horses and pack animals are generally 36 inches wide. Trails designed for wheelchairs, dirt bikes, and other users may require greater tread widths.

The tread is slightly *outsloped*—or tilted to the outside—to shed water. The outslope should be barely noticeable—usually no more than about 1 inch of outslope for every 18 inches of tread width.

The uphill side of a trail is its *backslope*. The backslope is smoothed to remove soil that might fall or wash onto the tread. The downhill side of a trail is called the *downslope*. The downslope usually requires little construction or



repair work. Groups maintaining trails should try to avoid damaging downslope vegetation that is stabilizing hillside soil.

BRUSHING

Brushing is the task of removing branches, bushes, vines, windfall, uprooted trees, and other vegetation that has encroached upon a trail. Its purpose is to maintain a *travel corridor* of sufficient width and height to allow trail users to pass easily.

As they stand in the center of a trail, volunteers can estimate the corridor clearance by stretching their arms sideways, then reaching over their heads. Trails intended primarily for hiking require a travel corridor about 6 feet wide and 8 feet high. Trails for horseback riders require a larger corridor—about 8 feet wide and 10 feet high.

The tools most useful for brushing are loppers, bush saws, clippers, and pole saws. Anyone using a pole saw should be encouraged to wear a hard hat and goggles as protection from falling sawdust and branches.

The following guidelines will help volunteers to brush a travel corridor so that it looks as natural as possible:

- ◆ Cut bushes and saplings flush with the surface of the ground. Don't leave stumps sticking above the earth where they can trip a hiker or injure the foot of a horse.

- ◆ *Undercut* tree branches by sawing through about one-third of their diameter from underneath, then complete the cut from above. This technique will prevent the falling branch from stripping live bark off the tree.

- ◆ Cut branches close to tree trunks to avoid leaving "hat racks" that can snag clothing, packs, or horses. Rather than cutting most of the limbs off a small tree, consider removing the entire tree. Young trees encroaching on the sides of a trail can be removed with loppers or handsaws.

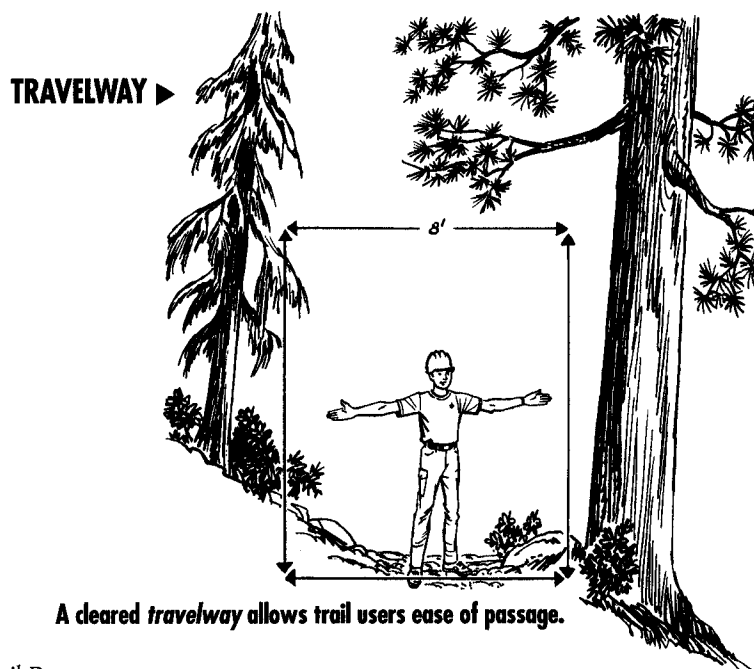
- ◆ Consult resource managers before cutting large trees in the trail corridor. Their removal may not be necessary or desirable.

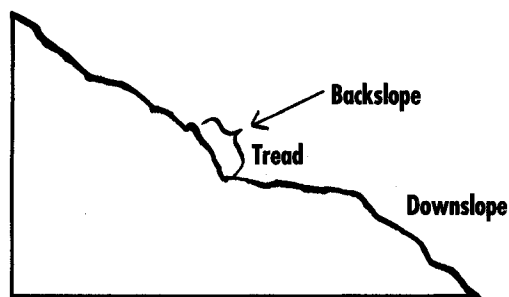
- ◆ Cut all stumps flush with ground level. Rub stump cuts and limb scars with soil so that they blend into the background.

- ◆ Carry brush and branches out of view of the trail and scatter over a wide area. Vegetation lying on the ground will decompose quickly.

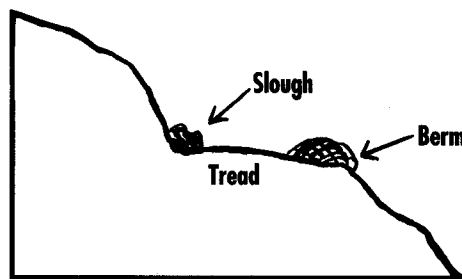
TREAD MAINTENANCE

Almost every trail will be exposed to water during the year from rain, melting snow, or springs. The *outslope* of a good trail allows water to flow immediately off the surface. If water is trapped on a pathway and allowed to run along a trail, it may erode the tread. As erosion carves increasingly deep ruts, the pathway eventually will be destroyed.





Rainwater running from the backslope to the downslope of a trail may deposit silt on the tread. Removing this *slough* and *berm* can restore a trail's proper width.



Removing Slough and Berm

A common trail problem is the buildup of silt on the inside edge of the tread (where it is called *slough*) and the outside edge (where it is called *berm*). As slough and berm become compacted, they narrow the usable part of the tread and make passage more difficult. Water trapped between slough and berm can flow along the trail and gouge the tread.

Mattocks, Pulaskis, McLeods, shovels, and rakes are effective tools for removing compacted slough and berm. Loosened dirt can be packed into ruts to smooth the trail, scattered in a wide area across the downslope, or loaded into wheelbarrows or buckets and used to repair ruts elsewhere on the trail.

Building Water Bars

Removing slough and berm can erase many signs of erosion, but discouraging future water damage may require the installation of water bars at points along the trail where they

can turn water away from the tread. Water bars can be built either of logs at least 8 inches in diameter or with rocks that can be fitted tightly together.

Dig a trench across the trail at a 30- to 45-degree angle and position the log or rocks. The trench should be deep enough to bury the water bar so that only a few inches rise above the level of the trail tread. Set the log or the rocks very firmly in the trench. A water bar must withstand many years of impact from the feet of hikers and, sometimes, the wheels of bicycles and the hooves of horses. Don't be satisfied with a water bar you are building until it stays in place as you jump up and down on it.

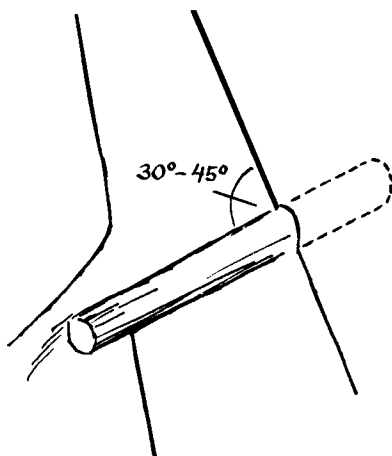
Outslope the tread up the trail from the bar so that water flowing down the pathway will curve off the tread before it hits the log or rocks. The bar itself should be a barrier of last resort to turn any water that flows beyond the outsloped tread. Place some rocks on the downslope to prevent erosion by water that the bar has steered from the trail.

LAY WATERBAR ROCKS...

LIKE THIS...



NOT THIS... OR THIS.



Water bars prevent trail erosion by diverting water from the tread.

Maintaining Water Bars

Over time, silt can build up behind a water bar and render it useless. With a shovel, McLeod, mattock, or the heel of your boot, scrape away the silt and restore the shape of the drainage slope so that the water bar will again be effective. Replace rotted logs and reset or replace loose rocks.

TURNPIKES

A turnpike will raise trail tread high enough to keep it dry as it crosses an area that is frequently boggy. Begin by digging a foundation ditch on either side of the proposed tread, keeping the inside edges of the foundations about 36 inches apart.

If you're building with stone, lay a row of rocks in each ditch. Use the same care as you would for building any rock structure—match the rocks to form a fairly flat top surface,

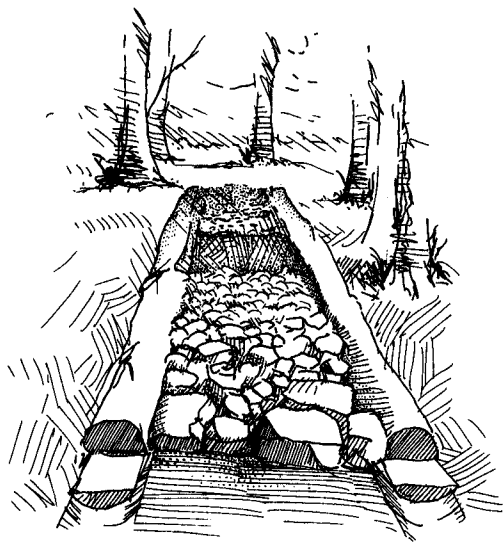
embed each rock solidly in the earth, and fit every rock tightly against the rocks on either side of it. A properly placed rock should not move when you stand on it.

Where timber is available, use a log at least 8 to 10 inches in diameter for each side of the turnpike. Bury at least half of the logs in the trenches. Driving wooden stakes will help hold the logs in place.

The best materials for filling a turnpike are layers of small stones or crushed rock covered with 6 inches of soil. The stones will allow moisture to flow through the turnpike while the soil, crested up in the center, makes a suitable tread that sheds rain.

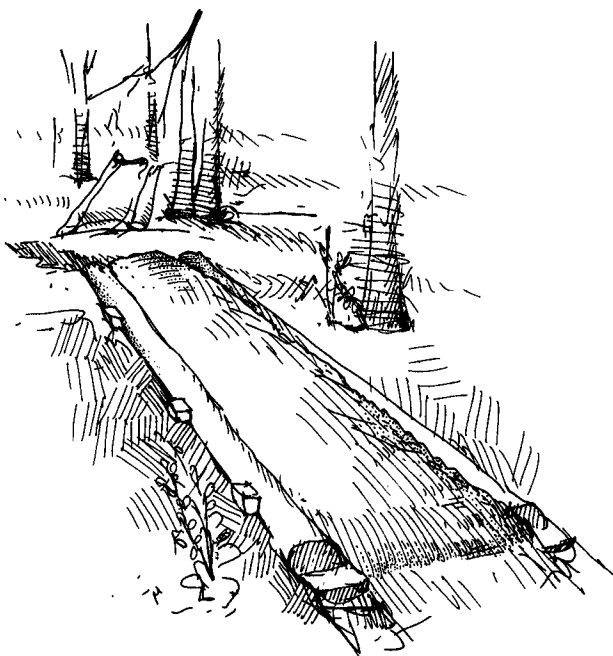
ROCK WALLS

Retaining walls carry trails around switchbacks, across rugged terrain, and over tree roots and outcroppings of stone. Most rock walls constructed in rustic settings are *drywalls*—

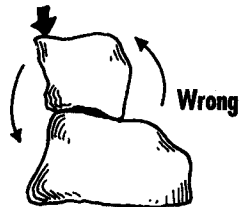


The side logs of a turnpike hold rocks topped with dirt to raise the trail tread above boggy ground.

BUILDING A TURNPIKE

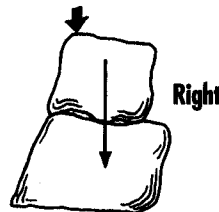


Wrong
Pressure applied here ...



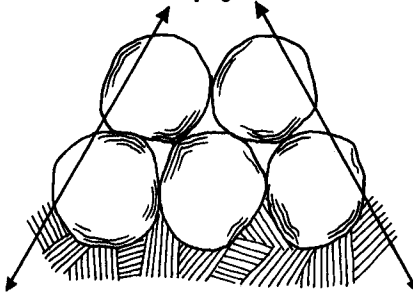
... may result in rotation.

Right
Pressure applied here ...



... is transferred into the wall.

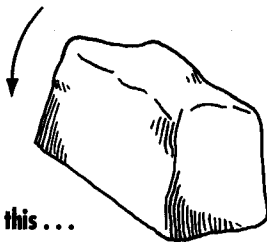
When laying round rocks ...



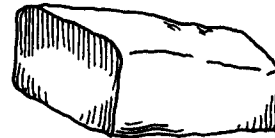
... use an "average" face.
... the same drywall principles apply.

(Source: *Trail Handbook—Sequoia and Kings Canyon National Parks*, 3d edition, Stephen S. Griswold, 1989)

Wrong
Rocks laid like this ...
are not as strong ...



Right
... as rocks laid like this.



structures built without mortar. Gravity holds the stones in place. Every stage in drywall construction augments the effectiveness of gravity, and thus increases the sturdiness of the wall.

Begin by digging down until you reach solid, undisturbed earth, then clear a shelf a bit wider than the average width of the rocks you will be using. Tilt the footing slightly inward so the wall will lean into the hillside.

Ideal stones for building walls (or any other rustic rock structure) have well-defined edges and large, relatively smooth faces. Bigger is usually better than smaller; angular is better than round.

Lay the first rock at the lower end of the foundation. Because it will act as a buttress for the entire wall, use one of the largest rocks you have. If possible, butt it against an existing stone outcropping to anchor it in place.

Excavate beneath the rock to provide a snug fit in the footing (like settling a large tooth into a gum line). A garden trowel can be useful for shaping the foundation. Use small stones and gravel to fill any voids behind the rock.

Place the next rocks tightly beside the first so there is solid contact between them. If the top surfaces are roughly level, you will

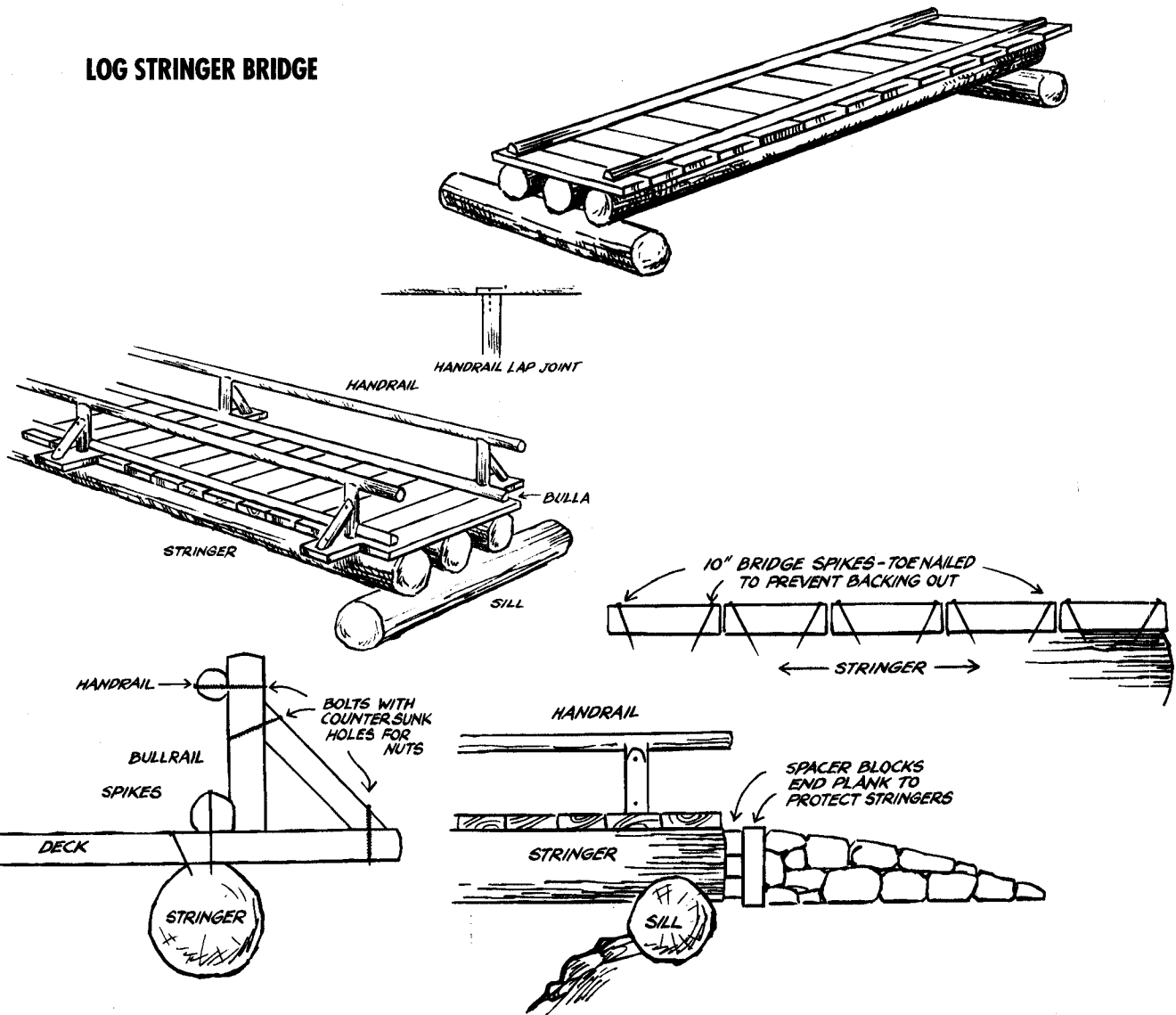
have an easier time laying the subsequent tiers. Wedge small stones *behind* the rocks to stabilize them. Fill material will bury those wedges and lock them into place. Stones wedged into the front of a wall may be loosened by freezing and thawing.

As you place each rock, see that it makes solid contact with neighboring rocks, then stand on it and bounce up and down. There should be no movement in the rock. If the rock is loose, secure it with stones wedged in from behind, or pull it out and try other rocks until you find one that fits well.

Lay the upper tiers with the same care. Wherever possible, rocks in the second tier should "break the joints" of the row beneath to link together all the tiers of wall. As each tier is completed, fill behind it with stones, soil, or crushed rock.

Save some larger rocks for the top tier. Known as *capstones*, their weight will help hold all of the tiers in place. Fill behind the capstones with small rocks and, if it is available, spread 4 to 6 inches of soil over the top of the fill to form an inviting tread surface for hikers and pack animals.

LOG STRINGER BRIDGE



TIMBER PROJECTS

Trail workers in many parts of the country have a tradition of using logs and milled lumber as materials for building retaining walls, overlooks, steps, bridges, boardwalks, shelters, and cabins. Wooden structures can be very durable and often blend well with natural surroundings. In remote locations, timber secured near project sites may be the only construction material available.

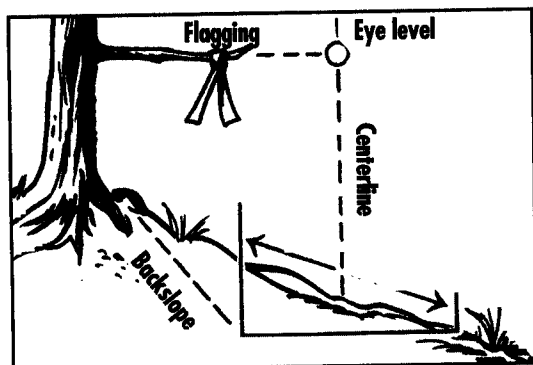
An added attraction of working with wood is the craftsmanship it involves. The techniques used today to build rustic structures are essentially the same methods practiced for hundreds of years by pioneers, shipwrights, and foresters. The saws, chisels, axes, and other tools of timber work harken back to the early days of the American frontier. Volunteers and group leaders interested in learning traditional timber

construction are tapping into a wealth of skills that can be interesting, useful, and satisfying.

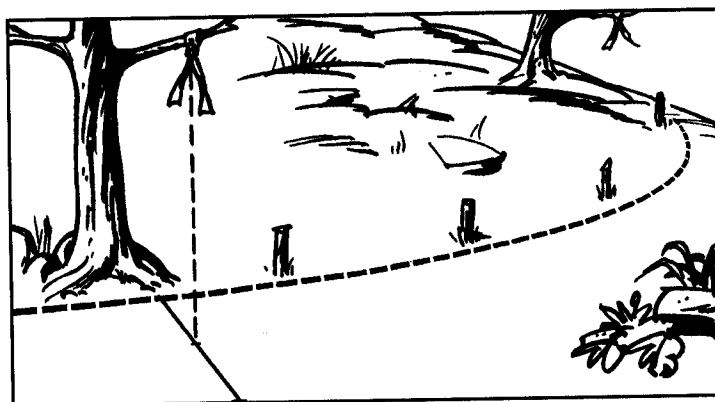
Through TRAIL Boss, group leaders and resource managers skilled in rustic timber construction can share their expertise with other leaders and volunteers who are willing to dedicate time to learn the art of working with wood. Workers can complete important projects in the field while also keeping alive the legacy of traditional timber construction methods.

HOW TRAIL PROJECTS ARE MARKED

Agencies often mark prospective trail work so that crews can find project sites, understand what they are to do, and accurately record their progress. While marking methods vary, the most common procedure uses wooden



MARKING A TRAIL



stakes driven into the ground at key locations along a trail. Numbers written on each stake indicate how far it is from the beginning of the trail. For example:

- 00 + 00 (no distance; appears at the beginning of a route)
- 00 + 50 (50 feet beyond the beginning of the route)
- 01 + 00 (100 hundred feet beyond the beginning of the route)
- 03 + 75 (375 feet beyond the beginning of the route)

Equipped with a measuring wheel and a pack full of stakes, resource professionals can mark all of the maintenance work to be done on a trail and produce a list that volunteer groups can use to find their projects. A few lines of a work list might look like this:

- 00 + 75—install water bar
- 01 + 10—begin rock retaining wall
- 01 + 22—end rock retaining wall
- 02 + 44—cut back tree roots

TRAIL Bosses reading the list can lead their groups directly to the projects that resource managers have decided will most

benefit a trail. Following the list above, for example, a TRAIL Boss could walk 75 feet along the trail and come to a stake in the ground marked 00 + 75. Written on the stake or on a piece of flagging tape tied to the stake will be the message *build water bar*.

NEW TRAIL CONSTRUCTION

Volunteer groups sometimes are invited to help construct new trails. The route of a proposed trail should be carefully surveyed and marked by resource managers before volunteers arrive. Wooden stakes generally are used to show where the tread will be built. A single row of stakes can signify the center of the proposed tread, or stakes may be placed to locate the inside and outside edges of the trail.

Building trails across flat or gently rolling terrain may require little more than clearing brush, moving rocks, and making the route obvious. As hikers use the new trail, their steps will beat down the tread.

Trails that cross steep hillsides are often built by digging a *full bench cut* so that the entire width of the tread lies on solid, undisturbed

earth. An effective way to direct a crew building such a trail is to use a mattock or shovel to scratch a line on the ground where the inside edge of the tread will be. Station crew members at 15- to 20-foot intervals and instruct them to dig straight down along that line until they have uncovered a trail tread of the proper width.

Trail widths usually are 24 inches for hiking trails and 36 inches for trails used by horses. Give volunteers a quick way to measure that width by marking each tool handle with duct tape at 24 inches or 36 inches. By laying a tool handle across the tread, workers can determine when the tread they are building is wide enough.

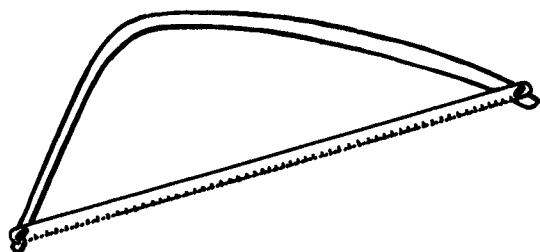
Once the tread has been roughed out, the groups can smooth it into shape with shovels and McLeods. Volunteer trail builders usually leave the tread sufficiently outsloped for good drainage even when they think they have made it level. You can judge whether the tread has too much outslope simply by walking on the trail. If it feels tilted under your feet, then it needs to be made more level.

Finally, the crew can form the *backslope*. Remove any soil, rocks, and gravel from the backslope that is likely to fall onto the tread during rainstorms.

TOOLS FOR TRAIL WORK

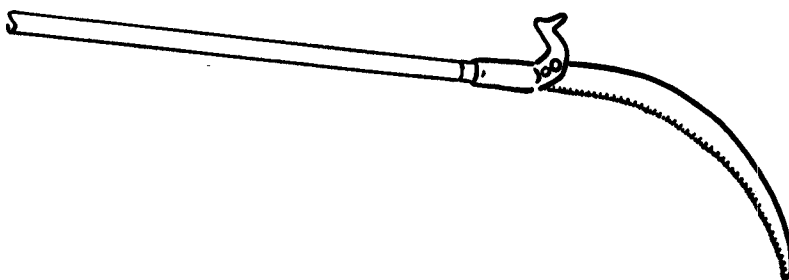
Bow Saw

A bow saw with a blade 16 to 36 inches in length is handy for cutting brush and trimming branches. If a saw has no sheath, make one by splitting open a piece of old garden hose as long as the blade. Fit the hose around the saw blade and hold it in place with cord or duct tape. A sheathed bow saw can be carried by hand or strapped onto a backpack. ▼



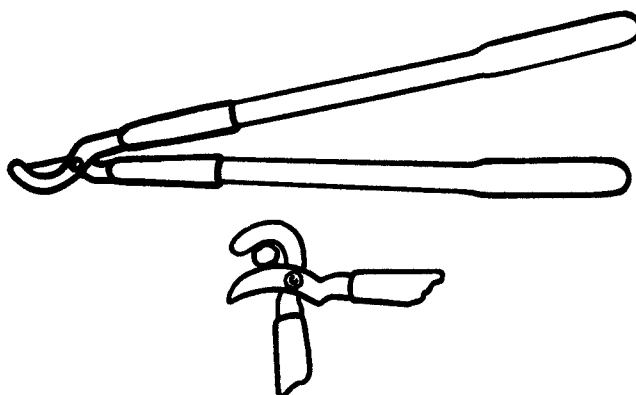
Pole Saw

A pole saw can be used to trim branches more than an arm's reach above a trail. On some models, the pole can be taken apart and the blade removed for easy carrying. ▼



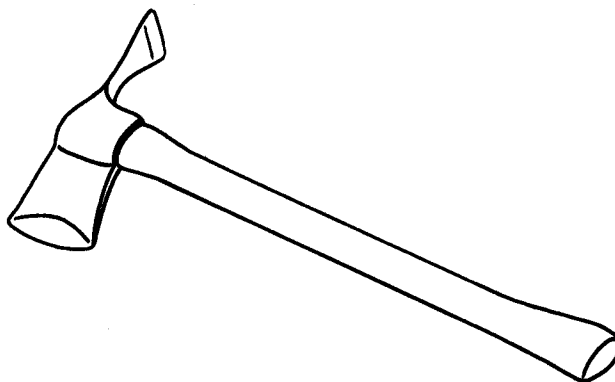
Loppers

Loppers are designed for clearing heavy vegetation from trails. A sturdy pair will cut cleanly through all sorts of brush and branches. Carry loppers with the jaws pointed down and away from you or strap them against the back of a pack. ▼

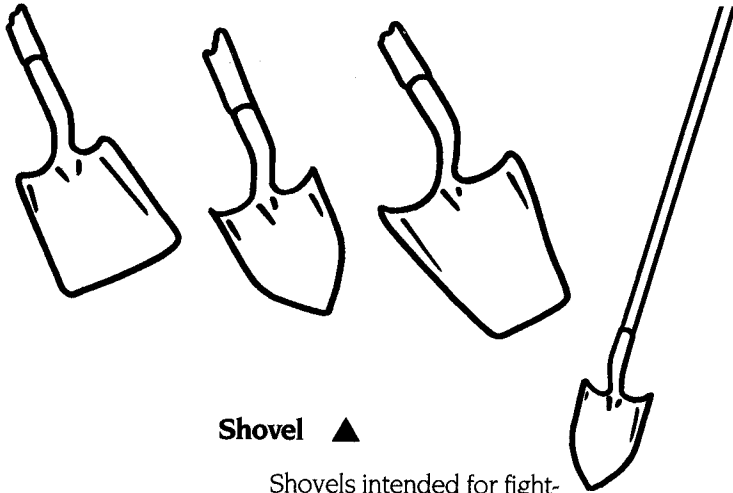


Pulaski

The Pulaski combines an ax bit with an adz-shaped hoe. With the bit and adz keenly honed, a Pulaski is an excellent woodworking ▼



tool for shaping the notches and joints of turnpikes, bridges, and other timber projects. Pulaskis also can be used to loosen dirt and cut through roots, but such use will quickly dull the edges.



Shovel ▲

Shovels intended for fighting forest fires are especially useful for conservation projects. They are lightweight, sturdy, and can be sharpened to cut more easily through ground cover and soil.

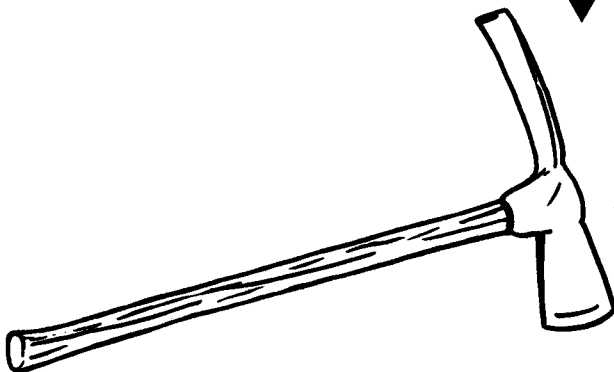


Grub Hoe ▲

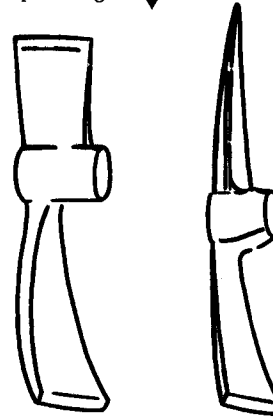
Grub hoes are good for building and repairing trail tread and for digging trenches to hold turnpike logs and water bars. Grub hoes are not usually sharpened.

Mattock

A mattock is a sturdy grubbing tool with an adz blade that can be used as a hoe for digging in hard ground. The other blade of a



mattock may be a pick for prying out rocks or a cutting edge for chopping roots. The handles of grub hoes and mattocks can be removed for ease in packing. ▼



McLeod

The McLeod is a forest fire tool common in America's western mountain ranges. The cutting edge opposite the tines can be sharpened with a file. The McLeod is useful for removing slough and berm from a trail and smoothing tread. ▼



Because of its shape, the McLeod is an awkward tool to transport and store. Carry it with the tines pointing toward the ground, ideally with a sheath over the cutting edge. Store the McLeod standing up in an out-of-the-way spot.

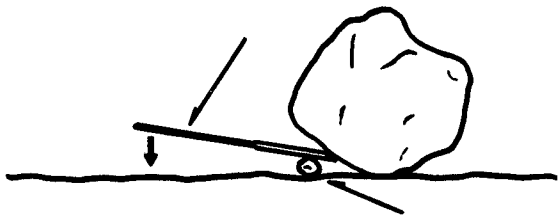
Rock Bar

The secret of using a rock bar is leverage. Slip the beveled end under a rock, then apply basic physics to raise the rock and ease it toward its destination.

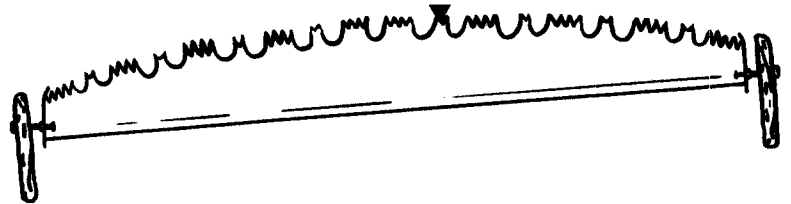


Crosscut Saw

Favored a century ago by loggers felling trees, the crosscut saw is still used to cut logs for timber projects and to clear large deadfall from trails and campsites, especially in wilderness areas and by volunteers who prefer not to



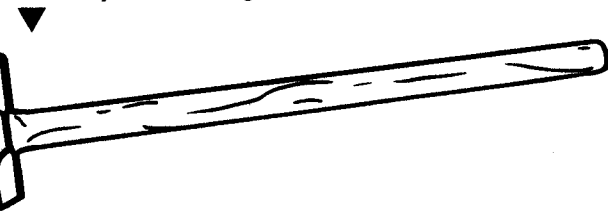
▲ As with all hand tools, rock bars require wise use. Keep toes and fingers clear of places where they could be pinched. Work as a team, making sure everyone understands each step of a rock move before it begins.



Sledgehammer

Sledgehammers are used to crush rock into gravel for trail repair and for driving large stakes into the ground to secure water bars and turnpikes. A sledge with an 8- to 10-pound

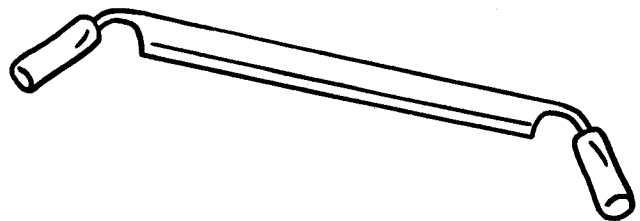
use chainsaws. Crosscut saws must always be sheathed before they are carried. A sheath can be made from an old piece of fire hose split open to fit over the saw blade.



head is suitable for most volunteers. Because a sledgehammer can cause stone chips to fly, anyone swinging the tool must wear eye protection, long pants, and boots.

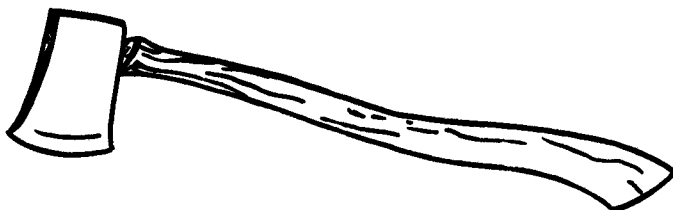
Drawknife

A drawknife is used to strip bark from logs for water bars, turnpikes, and other timber work. ▼



Ax

Axes can be used to chop deadfall from trails, shape stakes for turnpikes and water bars, and cut notches for structures made of timber. ▼



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